

CONSTRUCTION AND STANDARDIZATION  
OF  
AN ACHIEVEMENT TEST IN GENERAL SCIENCE  
FOR HIGH SCHOOL I YEAR STUDENTS

BY

✓ G.M.KHAN GHORI, B.Sc., B.Ed.,

A THESIS

SUBMITTED FOR THE DEGREE OF MASTER OF EDUCATION

UNIVERSITY OF NEDON.



## D E C L A R A T I O N

I 'do hereby declare that the thesis "Construction and Standardization of An Achievement Test in General Science For High School I Year Students" which I am submitting for the degree of Master of Education in the University of Mysore, is the result of an investigation - carried out by me under the guidance of Sri C. Rangachar, B.Sc., M.Ed.(Leeds), Principal, Teachers' College, Mysore..

Mysore.

10. 7. 61

  
Signature.

Riq. No. 201





## ACKNOWLEDGEMENT

I was fortunate in having the expert and experienced guidance and supervision of -  
Sri C. Rangachar, B.Sc., M.Ed.(Leeds),  
Principal, Teachers' College, Mysore, who  
is an eminent educationist.

I owe a very deep debt of gratitude to him.

I offer my thanks to Sri H.Venkataramaiah, B.Sc.,  
B.T., M.Ed., Lecturer in Education, Teachers'  
College, Mysore for his help and valuable  
suggestions during the preparation of the  
report.

I am grateful to the High School Teachers of  
the various High Schools in the state for  
their kind cooperation while conducting the  
test.

\*\*\*



# C O N T E N T S

<u>Chapter</u>		<u>Pages</u>
I	Introduction	1 - 20
	1) Science in the Modern World	1
	2) Meaning and Scope of Science	3
	3) Scientific Method	4
	4) Branches of Science	5
	5) Place of General Science	6
	6) Objectives of Science Teaching	8
	7) Measurable outcomes of Science Teaching	14
	8) Measurement of Education <sup>al</sup> outcomes	15
	9) Purpose of the Present Investigation	19
	<u>Achievement Tests:</u>	21
II	1) A brief survey	21
	2) Nature of Achievement Tests	30
	3) Principles of Achievement Test construction	35
III	<u>Construction of Achievement Test in General Science</u>	48
	1) Pre-try out	54
	2) Try-out	55
	3) Item Analysis and Selection of items for the final test	61
IV	<u>Administration of the Test</u>	70
	Choice of the sample	71
	Administration of the Test	76
V	<u>Standardization of the Test</u>	82
	1) Statistical Treatment	82
	2) Graphical Representation	88



Chapter

Pages

	3) Study of the Test Scores of the Entire Group	89
	4) Group-wise Study of the Test Scores	96
	5) Validity	
	6) Reliability	
	7) Norms	
	8) Comparison of Groups	
VI	Summary of conclusions and suggestions for further work	



LIST OF TABLES.

Page.

1	Types of test and number of items selected for the final test.	66
2	Distribution of the sample.	72 (a)
3	Frequency distribution entire sample	89
4	Frequency distribution of Rural	96
5	Frequency distribution of Urban	101
6	Frequency distribution of Industrial	104
7	Frequency distribution of Kannada Medium	108
8	Frequency distribution of English Medium	112
9	Frequency distribution of Boys	115
10	Frequency distribution of Girls	118
11	Rural Group	121
12	Urban Group	124
13	Industrial Group	127
14	Rural - Girls	130
15	Urban - Girls	133
16	Industrial Girls	136
17	Comparison of 6 Groups do 8 Groups	139 140
18	Frequency distribution to calculate biserial 'r'	147
19	Frequency distribution of fifty best and fifty worst	148





## LIST OF GRAPES

- 1 Frequency polygon for the Entire Group
- 2 do do Rural Group
- 3 do do Urban Group
- 4 do do Industrial Group
- 5 do do Kannada Medium  
English Medium
- 6 do do Boys (R.B.I)
- 7 do do Girls (R.B.I.)
- 8 do do Boys & Girls
- 9 Ogive showing percentile Norms for the whole Group
- 10 Ogives for Rural, Urban, Industrial
- 11 Ogives for Kannada Medium  
English Medium
- 12 Ogives for Boys and Girls.



## APPENDIX

### Appendix.-

- A Syllabus in General Science
- B Try-out Form
- C Final Test
- D Programmes
- E Proforma
- F Table of scores on odd and even numbered items
- G Table of Difficulty level and Discriminating Efficiency
- H Scores of 2023 candidates in the test.  
*Scores for calculating Reliability by eq<sup>n</sup>*
- I Key to score this test.
- J Bio biography



## CHAPTER I

### INTRODUCTION

#### Science in the modern world.

"The civilization of a race is simply the sum total of its achievements in adjusting itself to its environment"<sup>1</sup>. The nature and method of adjustment have been different at different times. We are living in a much more complicated and chaotic world than our ancestors. Science has revolutionized the material world in which we live. According to Whitehead "it has practically recoloured our mentality"<sup>2</sup>. Thus every thing about us has been influenced by science. Our dress, our food, our home, transportation and communication have all undergone remarkable changes depending upon scientific discoveries and inventions. Due to the benefits of science the world seems highly shrunk. Man to-day regards this universe too narrow for his activities. He has been probing into the other planets for greater comfort. The successful trip of Gagarin of Russia and Shepard of America in the outer space is ample proof of man's aspirations and abilities in understanding and overcoming the forces of nature with the help of science. Society must take advantage of such adventures and discoveries for the progress of the human race. "Science discoveries affect the every day lives of every one. Society must see how science must

---

1. Hu Shih, "The Civilization of the East and the West", in *Whither Mankind*, page 27.  
2. "Science and the Modern World", page 3, by Alfred North Whitehead.



be used for the satisfaction of human wants"<sup>1</sup>.

Pandit Nehru has aptly observed 'Science is now a new dimensional thinking for the solution of national and international problems. The future of the world lies not in the hands of the politicians but in the hands of Scientists and technologists'. Independent India wants men to outgrow their superstitious structure and develop a modern progressive scientific outlook to face the changing conditions of the universe due to atomic fission, radio activity and the sort in keeping with the advancements the western countries have been making in the field of science. It is not enough if there is a Raman for the whole country. Every Indian child must develop the reasoning pattern of Raman, imagination of Bose and the inquisitive nature of Ray, if India has to survive the struggle for knowledge and progress. Hence it is incumbent on the part of educators to see that children develop scientific interest and attitude right from the very beginning and do not waste their time in cramming some scientific information.

"In our schools and colleges, students tinker with a few test tubes and measurements, visualising of science as a laboratory issue. They are ignorant of wider implication in every day life and conduct. They are not being given scientific education at all, they are only

---

1. Laetitia Mogden, "Science for the Citizen", George Allen Unwin Ltd., page 12.





learning a dull subject to pass an examination".<sup>1</sup>

### Meaning and scope of science.

We had so far a glimpse of the influence of science on the modern world. But then what is science?

"Science is an inter-connected series of concepts and conceptual schemes that have developed as a result of experimentation and observation and are fruitful of further experimentation and observation. In this definition the emphasis is on the word 'fruitful'; Science is a speculative enterprise. The validity of a new idea and the significance of a new experimental finding are to be measured by the consequences - Consequences in terms of other ideas and other experiments. Thus concerned, science is not a quest for certainty. It is rather a quest which is successful to the degree it is continuous".<sup>2</sup>

Twiss summarizes the meaning of science as "knowledge so classified and organized that it may be used in acquiring other knowledges; that it implies not only content or subject matter classified and organized, but also a method of investigation or problem solving including observation and measurement, observation and logical inference - both inductive and deductive by means of which subject matter is organized and used in prediction, discovery and invention; that its subject matter is constantly growing

---

1. Saiyidin K.S., "Education, Culture and Social Order"

2. Bryant Conant, "Science and Common Sense", pages 15-16.



in volume and being brought under simpler and more comprehensive forms of description; that all human material is legitimate material for its investigation; that it grows out of the problems related to human needs, physical, industrial, social emotional and intellectual; and that it is so intimately connected with industrial development that neither can go on without the other"<sup>1</sup> Thus we see that science is a continuous quest for systematised and organized knowledge. Science is not a collection of facts. According to Poincare<sup>2</sup> "Science is no more a collection of facts than a building is a collection of bricks. Science is man's relentless search for the understanding of the environment. It is a search by man by exploring, enquiring, seeking accurate description and explanation. The answers are tentative, inquiry continuous, always something more to be learnt. It is a search for classified understanding or interpretation of the environment. These interpretation become the body of science knowledge. They are the concepts, principles generalization which state our best present interpretation of our environment. The product of a scientific enquiry is a body of classified concepts."

### Scientific Method.

The content and method of science have certain charac-

- 
1. Ransom Twiss, "Principles of Teaching Science", page 10
  2. "Journal of Science Education" Volume 45, February 1964, page 25.



teristics. The content of science consists, as mentioned above, of a continuously expanding body of systematized knowledge based upon scientific method. The method of arriving at knowledge in science is based upon certain principles. John Dewey opines "that the heart of science lies not in conclusions reached but in the methods of observation, experimentation and mathematical reasoning by which conclusions are reached".<sup>1</sup> Thus we may say that the conclusions reached must be according to a particular method which includes observation, experimentation and proper reasoning. That is to say, the student of science takes more pains than the man in the street does to get at the facts. He is not content with sporadic knowledge, but will have as large a body of facts as he can get; he summarizes the data, draws his inferences from them and sums up in a generalization or a formula. According to Burtrand Russell,<sup>2</sup> the essence of scientific method is the discovery of general laws through the study of particular facts. There are three stages in arriving at a scientific law (a) observation of scientific facts, (b) arriving at the hypothesis and (c) deducting generalizations which can be tested by observation or verification. In short scientific method is "Induction for deduction with a view to construction".<sup>3</sup>

#### Branches of Science.

Science has two major branches, pure science and applied science.

1. "Thirty Seventh Year Book of the National Society for the Study of Education", Part II, page 431.
2. Burtrand Russell, "Science", in "Matter and Method", page 43.
3. Quote quoted by Arthur Thomson in "Introduction to Science", page 43.



pure science aims at <sup>8</sup>understanding nature whereas applied science deals with predicting and controlling it. Pure science has many branches - physical sciences, biological sciences, and earth sciences. This division is purely intellectual. Science does not exist in nature on this compartmental basis. "The division of sciences are not like the different lines that meet in an angle but rather like the branches of trees that join in one trunk"<sup>1</sup> Science teaching on a compartmental basis is justified only for specialisation in a subject or for technology. On the other hand a basic knowledge of science, as it exists in nature in the natural surroundings of children, is essential for all. This is possible - only in an integrated course of study wherein all branches of science are included under the name of general science. Moreover in the early stages children see things as unanalysed wholes rather than the components.

### Place of General Science.

The Committee<sup>2</sup> on the Reorganization of science in Secondary schools in America issued a report as far back as 1920 stating that steps should be taken to prevent the increase in specialisation from diminishing the value of instruction from the standpoint of the general needs of the pupils and the needs of society. "It further stated that "general science should provide a basis for discovery of interest in special sciences". It should prove to be the best training for any pupil who can take only one

1. Bacon, quoted by Arthur Thomson in Introduction to Science, page 25.

2. Walter I. Lawrence, "Encyclopedia of Educational Research", page 1122.





course in science. The subject matter should be selected from the environment and hence should vary from place to place and should deal with problems of social reconstruction. The science of common use should be the science of the class room. The decision of the All India Committee on Secondary Education<sup>1</sup> to adopt the concentric method of teaching general science is quite in consonance with the above mentioned report. The Science Masters' Association of America<sup>2</sup> clearly defines general science in the following manner. "General science therefore should be a course of scientific study and investigation which has its roots in the common experience of children and does not exclude any of the fundamental sciences. It should seek to elucidate the general principles observable in nature without emphasising the traditional divisions into specialised subjects until such time as is warranted by the increasing complexity of the field of investigation, by the developing unity of the separate parts of that field and by the intellectual progress of the pupils".

The conditions obtainable in our State are not quite conducive to the teaching of general science at the present stage. The department should have introduced the scheme of science teaching on the topical method after training teachers in the art of teaching an integrated course of science. Most of the teachers do not have the

---

1. Draft Syllabuses for Higher Secondary Schools, page 21.  
2. Science Masters' Association of America.



academic qualifications for teaching the integrated course. Hence lack of complete knowledge on the part of the teacher result in lack of suitable interest in the pupils leading to an irregular patched type of knowledge unrealistic in its nature. It is a welcome sign that the department has thought of conducting a content course in science to eradicate the above mentioned flaw. General science is introduced as a course of study in the University. The prevailing defect would be permanently overcome when graduates with these optionals handle general science in high schools.

#### Objectives of Science Teaching.

Science ever since the times of Arabs has had two functions; first to enable us to know things and second to enable us to do things, says Burt-and Russell,<sup>1</sup> Science as has already been stated is systematized knowledge. This definition of science is giving way to science as a power for manipulating nature to the advantage of man. Learning or doing of any thing must have some objectives. Evidently teaching of science must also have some clear cut objectives. The Seminar on teaching of general science held in New Delhi in the year 1956<sup>2</sup> has proposed the following objectives for Science teaching (1) to familiarise the pupil with the world in which he lives and make him understand the impact of science on society so as to enable him to adjust himself to his environment and (2) to acquaint him with scientific me-

---

1. Burtrand Russell, "The Impact of Science on Society", page 21.

2. The First All India Science Seminar on Teaching of Science in India", page 35.



toed and enable him to develop a scientific attitude. In 1924 Watkins<sup>1</sup>, investigated the objectives for general science and his findings were to insure that the pupil acquires (1) an understanding and control of environment; (2) a fund of information concerning nature and science; (3) a preparation for later science courses; (4) a training in the scientific method; (5) development of power of interpretation, and application; (6) development of interest in science and (7) culture.

In 1927 Cureton<sup>2</sup> found the following to be the most important objectives of general science: (1) appreciation of the values and importance of science as it affects his daily life, so that he may acquire the proper attitude towards those civic scientific issues which he will later be called upon to lend his voice in solving, (2) to develop in the child these general attitudes and habits of broad mindedness, fidelity to truth, careful inquiry and evaluation of evidence in connection with problems and logical analysis of data which will tend to mould his character and temperament in the best manner; (3) to develop in the child interest in the value, worth and beauty of science, so that he may have opened before him a great number of interesting avocations and he may be stimulated to go further into one of the many fields of scientific endeavours, (4) to

---

1. Watkins Ralph, K., "The Technique and Value of Project Teaching in General Science", General Science quarterly Volume VII, pages 235-256.

2. Cureton, Edward E., "The Aim and Content of the Course of Study in General Science".



develop in the child those particular habits and attitudes and to present to him those particular facts and principles most likely to be of definite use to him both as a child and as an adult, (5) to give the child ~~and as an adult~~ a general preview of science to the end that he may have a better basis for the selection of further science work in school and perhaps in life. A study of high school curricula in America from 1860-1918,<sup>1</sup> reveals that the values of science teaching could be conveniently classified under the following heads (1) the religious aim (2) knowledge aim, (a) knowledge to the end that the learner may be regarded an intelligent person, (b) knowledge for its practical utility, (c) knowledge for mental discipline. These aims found recognition in educational literature and prefaces of text books. Writing about science study in his book "Natural History" for the use of schools and families Hooker states "This study has a practical learning on many of the most valuable and extensive occupations of man". "The practical benefit is - the discipline which it gives the mental powers".

Geyer F.B.A. in his book "laboratory manual in Biology" writes, "The aim of science teaching is to develop rather than to inform. Hence the laboratory method is more important than the information involved. Accuracy in observation is a pre-requisite for accuracy in description as well as to logical inference" In his book "Elements of Chemistry, Ira Remson said, that the course was not to make chemists

---

1. Walter Monroe, "Encyclopedia of Education", page 113.





but to help to develop sound aims and awaken interest in important natural phenomenon Smith in his discussion on teaching of Chemistry gives the following reasons for the study of Science. "Our first reason", he says, "rests on the training in observation for which it furnishes the opportunity. The second reason is that it trains the pupil in the organization of his observation by comparison and induction. A third is that of exercise and control of the imagination. He further states that science give training in self elimination (which may be defined as unbiased judgement). He recognized the value of information the study of science imparts. S. Ralph Powers writing in "The plan of public schools and the programme of Science Teaching" <sup>1</sup> states that "science must be viewed from two specific points - for the immediate educational values for high school pupils; and for the background of preparation they afford for the more intensive and specialized study of the sciences by those who continue in colleges later. Educational values of real significance will be attained if pupils as a result of such instruction acquire (1) the ability to use the scientific findings that apply in their experience, (2) the ability to interpret natural phenomenon in their environment and (3) an appreciation of scientific attitude through the understanding of, and ability to use, some of the methods of study that have been employed by scientists". From the multitudes of

---

1. S. Ralph Powers, "The Plan of the Public Schools and the Programme of Science Teaching", Thirty First Year Book of the National Society for the Study of Education, Part I, page 10.



the objectives mentioned above the aims of Science teaching can be grouped under four broad heads.

1. Utilitarian aim,
2. Disciplinary aim,
3. Cultural aim,
4. Social aim.

#### Utilitarian aim.

Children must be given such knowledge of science as has direct contact with the affairs of their daily life. Great importance must be given to scientific principles of wide generality so that their understanding may lead to useful application in solving the problems of life. Science must also be used to harness the forces of nature to the advantage of man.

#### The disciplinary aim.

Teaching of science must thrill the students and sharpen their minds. It must inculcate in them the habits of accurate observation, separating the relevant from the irrelevant in a purely objective manner, uninfluenced by bias or prejudice. It must develop openmindedness and unyielding attitude to authority and superstition. Teaching of Science must develop the spirit of inquiry. The methodical procedure in experimentation and observation and the scientific outlook they develop in a course of scientific study - should go a long way to help them tackle life problems on a scientific basis.



Cultural Aim.

The culture of a race is the sum total of the modifications and adjustments it has undergone to suit the changing conditions. The social heritage shows us the way our fore-fathers have reacted to certain environmental conditions to suit their interest and the interest of their descendants in similar conditions. Our children should also have something to hand over to the future generation. Teaching of science must arouse their interest in mysterious - happenings in their environment and they must quench their inquisitive thirst by self effort. We have inherited the knowledge of aeroplane from our predecessors and we hand over the knowledge of jet planes, atomic fission, atomic energy and inter-continental missiles to the future generation. Knowledge is a legacy from the past and a gift to the future.

Social aim.

Science has and has been changing our social life. Our ways of transportation, communication, agriculture, trade and commerce have all been influenced by science. The world of to-day is too small, when advantages of science are made use of. One may break-fast at Bombay, lunch in London and dine in New York. The child must be enabled to adjust itself to this sort of social progress and the ever-changing ways of life. The child must develop healthy habits, scientific attitude and a corporate way of life.



### Measurable outcomes of Science teaching.

In the fore-going paragraph the objectives and aims of science teaching have been dealt with at length. Here mention is made of the measurable outcomes of science. There are five types of major measurable qualities in science - knowledge, skills, concepts and understanding, application and interests and attitudes.

#### Knowledge.

Information and knowledge are emphasised in science teaching. Knowledge is a necessary criterion for satisfactory adjustment to life, though it cannot be said that mere possession of knowledge would lead to proper reaction. Hence measurement of the knowledge of scientific information is essential.

#### Skills.

Skill in handling scientific instruments, apparatus and tools and performing experiments is as essential as knowledge. For example the pupil should have the skill to use a cycle pump and should be able to set it right should it go out of order; or he should know how to replace a fuse in case it is burnt out.

#### Concepts and understandings.

As facts are the vehicles of thought, the relation between facts and generalisation is the vehicle of understanding. Attainment of generalized ideas in science is indispensable. Tests on this aspect of learning cannot be lost





sight of.

### Application.

Application of scientific knowledge is the most important objective of science teaching. Test items that involve understanding of new situations demand the ability to use scientific knowledge, reasoning and judgement. Test items of this kind must find a place in any testing programme of science.

### Interests and Attitudes.

Tests on interests and attitudes are as important as any other outcome of science. They are the signals which indicated the future professions, occupations and hobbies of the pupils. Constructing tests on this aspect of the outcomes is not easy. All the same all possible efforts should be made to test this outcome.

### Measurement of Educational outcomes.

In the previous paragraphs enough light is thrown on the broad aims of science teaching and its measurable outcomes. The out-comes of science teaching, as any other subject, have to be subjected to measurement in order that we may reap the full benefit of the programme of science teaching in our schools. "Measurement is the principle implement of science changing that field of human endeavour from medieval gropings into modern exactitude".<sup>1</sup>

---

1. B.Othanel Smith, "Logical Aspects of Educational Measurement", page 182.



Sir Galton is of opinion that until the phenomena of any branch of knowledge have been subjected to measurement and number, it cannot assume the status and dignity of science.<sup>1</sup> What are the different types of measurement available? There are two major types of measurement, the essay type and the new type or objective type. Time and again the defects of the old type or essay type of examinations have been pointed out. It is subjective, unreliable, invalid, time consuming both on the part of the pupil and the examiner and suffers from lack of wide sampling and definiteness of questions. It is needless here to go into the details of studies made by Starch and Elliot, Ballard, Falls, Willis, Hulton and others regarding the alarming short comings of the essay type. In a study made in the University of West Virginia, Ashburn<sup>2</sup> came to the conclusion that 40 per cent of the passes or failures depended not on what they knew but on who read the papers and the passing or failure of 10 per cent depended upon when the papers were read. In contrast to those the new type of examinations are more objective, highly reliable and much more valid. They enjoy wide sampling, dependability and clarity. They are easy to administer less time consuming and more thought provoking.

George Fisher<sup>3</sup> an English School Master, realising the subjective nature of the essay type of examinations

- 
1. Sir Francis Galton, quoted by I.W. Howerth page 1 of "Measurement of Mental Phenomena".
  2. Robert M. Ashburn, "An Experiment in the Essay Type of Question", Journal of Experimental Education, Sept., 1935.
  3. Leonard P. Ayres, "History and Present States of Educational Measurement", Seventh Year Book of the National Society for the Study of Education, Part II, page 9.



proposed a "scale book" made up of various standard specimens of handwriting arranged in order of merit. But this did not produce a lasting effect. Ayres<sup>1</sup> feels that this is due to the fact that the people in those days did not believe that human behaviour was susceptible to quantitative study. The real inventor of the comparative test in America was J.M.Rice.<sup>2</sup> In 1894 he constructed tests in spelling, arithmetic and language to discover the minimum time required to teach these subjects. It took ten years for his attempts to get the approval of educators. In 1904 Thorndike<sup>3</sup> gave the world his memorable book "Mental and Educational Measurements". Thorndike is rightly regarded as "the father of the objective test movement". Stone, a student of Thorndike, published the first standardized test in Arithmetic in 1908. This was followed by Thorndike's "scale for handwriting for children" in 1909. Thus came into use the objective tests in America. Though educators were first opposed to these, the defective nature of the other type of examinations and the objective nature of the new type compelled them adopt the latter.

Even in India educationists have not been blind to the evil effects of the present system of examination. A thorough re-orientation of examinations has been a long felt need. As far back as 1938 the Zakir Hussain Committee

---

1. Leonard P. Ayres, "History and Present States of Educational Measurements", Seventh Year Book, Part II, page 10

2. Leonard P. Ayres, page 11

3. Ibid, page 13.



stated<sup>1</sup> "The system of examinations prevailing in our country has proved a curse to our education. A bad system of education has, if possible, been made worse by awarding examinations a place out of all proportion to their utility. Examinations are neither valid nor complete, they are inadequate and unreliable, capricious and arbitrary". The same Committee suggests the administration of objective tests constructed in consultation with the experts in curriculum making. Dr. Radha Krishnan in his report has clearly indicated the common profound dissatisfaction with the existing system of examination and its down-right condemnation in no unmistakable terms. The report says, "Examinations, as they have been functioning, have been recognised as one of the worst features of Indian education, with its pernicious domination over education .... they kill all initiative in the teacher and the student .... have made it almost impossible to provide true education and to develop wider interests and have created temptation of cheating and corruption". In his opinion "The obsession to secure as it were a ticket in the lottery of job-securing has overshadowed the educational purposes which a good examination can serve".<sup>2</sup> The Commission feels convinced that "If we are to suggest one single reform in education, it should be that of examinations". The Commission suggest, however, is not in favour of abolishing the examination. On the other hand it recommends the improvement of the existing system

- 
1. Menzel, "The Use of New Type Tests in India" -preface.
  2. Radha Krishnan, "University Commission's Report", pages 327-329.





by the introduction of "valid, reliable, adequate objective examinations".

The Mudaliar Commission on Secondary Education declares "Examinations have so pervaded the entire atmosphere of school life that they have become the main motivating force for all efforts on the part of the pupils as well as teachers. If any school activity is not related directly or indirectly to the examination it fails to evoke or enlist the students' enthusiasm - they have come to exercise a restricting influence on the entire field of Indian education to such an extent as almost to nullify its real purpose". All the above reports indicate their disgust only with the - existing type of examination in our country. This does not mean to advocate the abolition of examinations as such but only a change over to the new objective type of examinations.

Dr. Benjamin S. Bloom, the American expert on evaluation who conducted a number of evaluation workshops in India has revolutionized our conception of examinations by introducing objectivised tests in the field of education. This has given a new fillip to the evaluation technique in India and many efforts are being made in this direction. The present investigation is a humble venture to standardize an achievement test in general science for High School First Year as per the syllabus of the Old Mysore State. The test was administered to a sample of 20-23 students representing the various parts of the Mysore State under various managements and under different socio-economic



society - Urban, rural and industrial. Mysore and Bangalore are taken as urban areas, Mandya, K.G.S. and Bhadravathi as industrial and the other parts as rural areas.

The test is a battery of nine sub-tests. Instructions and samples are given at the beginning of each sub-test.

\* \* \*



## CHAPTER -II

### Achievement Tests.

#### Achievement Tests - A Brief Survey:

Although the measurement of achievement in Schools, is traced back to many centuries, the objective measurement dates, as already referred to, from the works of - Thorndike and his pupils. In 1918 Thorndike published a paper, the first of its kind, on measurement. It began with the dictum "Every thing that exists, exists in some amount, and that, if it exists in some amount, it can be measured".<sup>1</sup> It counteracted the opinion of those who believed that ideas and emotions could not be measured. The spelling and arithmetic tests of J.M. Rice, the Arithmetic tests of Stone, Elementary test of Curtis, Thorndikes Handwriting scale, Ayres Handwriting scale, Hellegas Composition scale, spelling scale of Buckingham and Starch's Reading Test gave the incentive to objective measurement of Achievement.<sup>2</sup>

In 1911 Curtis<sup>3</sup> reported the results of his test in the fundamentals of arithmetic, administered in the - Detroit School. The report attracted so much attention that Curtis was asked to participate in the New York survey and administer his test to 30,000 pupils. The report

- 
1. Ballard: "Mental Measurements, page 2.
  2. Encyclopedia of Education, page 1461-62.
  3. Ibid, page



of the use of tests stimulated much interest among heads of institutions who were eager to compare the achievement of their pupils with the pupils in other schools. Courtis laid emphasis on the importance of norms. Thanks to his valuable efforts, a bureau was established in a number of States to cooperate with school men in administering tests and interpreting test scores. These endeavours led to the popularity of Achievement tests. From 1917 - 28 nearly 1,300 standardized and semi-standardized tests were developed. Surveying the advance the test movement was making, Buckingham<sup>1</sup> observed that the "test making passed from an amateur to a professional basis". Walter Monroe<sup>2</sup> in his book "Ten Years of Educational Research 1918-27", writes that the pioneer State of Educational Research is passed and quantitative production has been achieved. By 1927 there were developments in the new direction and this indicated a distinct advance. The early standard tests of Achievement were purely of a general or survey type. They were a measure of a pupil's attainment in a subject. They did not give detailed information required for remedial work. These tests gave way to tests of a specific type like diagnostic tests which give specific information regarding the pupil's strong and weak points. The tests were later organized into batteries consisting of survey tests in im-

- 
1. R.B. Buckingham, "Our First Twenty Years", Proceedings of the National Education Association, 1941, page 354.
  2. W. Ross, "Measurement in To-days' Schools", page 43.





portant school subjects in a single book-lets. In 1920 two such batteries appeared - one by Pinter and the other by Monroe and Buckingham. In 1922 appeared the Stanford Achievement Test. In 1929 the State University of Iowa inaugurated a State-wide Every Pupil Testing Programme. An innovation in Achievement testing was made by Lindquist in 1942 with the Iowa test of educational development. These tests, designed to measure the basic skills, permanent learnings and attainment of other objectives of education, were substituted for the strictly subject centered tests of the original Iowa Every Pupil Testing Programme.

#### Achievement Tests in Science:

A good many achievement tests in science have been standardized by various people in America and elsewhere. A brief mention of a few may not be out of place here.

##### I Stanford Achievement Test.

The format, lay out, spacing and size of type of the Stanford Achievement Test are commendable. This test is found in many forms. Each form consists of seventy items. A great majority of items involves factual information. There is no item which involves judgement and reasoning. All the items are of multiple choice type. Many of these are incomplete statements except a few direct questions.



Each item has three possible answers instead of four or five. There are also some defects. An item when completed correctly reads thus: "Humus is soil found chiefly under trees" The framing of this item is not correct because Humus is one of the three constituents of soil, whether under trees or not.

## II Co-operative Biology Test for High Schools:-

This test is constructed by cooperative Test Division, Educational testing service. The test consists of 5 forms. Form Q consists of 120 items. There are five choices given for each item. About one third of the items test biological information. The remaining two thirds are basically factual. Form S is composed of 111 items. About 25 per cent of the items test the application of biological information and the interpretation of materials. The instructions are clear and simple. Data regarding test objectives, construction and validity studies are inadequate. The manual does not say how the questions were selected, what the item difficulty and validity indices are, on which population was the testing data obtained etc. It does not say also how it was validated and how its reliability was determined.

## Nelson Biology Test:- 1950-51.

This is constructed for use at the end of a course



in high school. There are two forms of the test. Each of these forms consists of 75 items of multiple choice. The cover page contains directions and samples. The get up of the test is commendable. The questions are clear, direct and free from ambiguity. Importance is given to the understanding of Scientific phenomena and the ability to apply knowledge in the interpretation of situations and solution of problems. The reliability of the test has been calculated by the split half method. It has a reliability of 0.88.

#### Cooperative General Science Test:-

This is constructed by Paul E Kambly and Carl A Pearson for the Cooperative Test Division Educational - Testing Service. This test has been criticised by S. Richardson, Associate Professor of Education of the Ohio University, Columbia. This test is used as a measure of achievement at the end of course. The number of items in each form ranges from 85 in Form Z to 101 in form Q. With the exception of a few matching items in Form Q, all items are of multiple choice type. Each form is divided into two parts with 20 minutes allowed for the first part and 15 minutes for the second part. There is no apparent order in the listing of the items. There is considerable dependance on the re-call of factual information. To a very small extent principles of science are involved in



determining the correct response.

In item 34 of Form X, the key indicated that the correct answer is "water is a good conductor of electricity". Actually water is a poor conductor till some acid is added to it.

### Anderson Chemistry Test:

This test is constructed by Kenneth Anderson. The working time for this test is 40 minutes. Directions and samples worked are found on the covering page. The test is in two forms. Each form consists of 80 questions of the multiple choice type, with five choices in each. This is a test not only of factual knowledge but also of the students' understanding of principles, familiarity with laboratory work, and reasoning ability.

Item 47 in form A reads "Hydrogen gas was passed into a test tube containing copper oxide. Heat was then applied to the tube.

<sup>asks,</sup>  
Item 48<sub>A</sub> "Which one of the following statements - gives the principle that test explains the answer to item 47?" (6) Copper is comparatively an inactive metal (7) Metallic oxides often combine with an acid to form a carbonate. (8) many oxygen compounds when heated with hydrogen with release oxygen. (9) Noticeable heat and light occur in many chemical reactions. (10) Some chemical com-





pounds are able to absorb water from air". Answer 8 is considered correct but Rieman considers that item No. 6 also is an equally good answer. Though Reiman, (Professor of analytical Chemistry, Rutgers University, New Jersey) has criticised item 48 in Form A (given <sup>above</sup> below), it does not seem to be valid when we take into consideration the knowledge of students as per the ~~specimen~~ <sup>level</sup>.

#### Read General Science Test:-

In this test there are 75 items. The time is 40 minutes. The distribution of items by content areas is; Physics 42 per cent; biology 28 per cent; Chemistry 4 per cent, and general 26 per cent. The sampling of the areas does not allow of adequate diagnosis of academic achievement. The wording is clear and exact. There is considerable reliance on the re-call of factual information and utilization of principles of science. Benjamin B. Bloom has highly commended this test from a statisticians point of view. Preliminary forms of the test were administered to 1,600 students in 12 high schools in 8 States near the close of the year. The mean IQ of the group was 102. The mean validity index (item total correlations) was computed and found to be .42 and .43 for the two forms. Items were selected so as to yield two forms of the test precisely balanced in difficulty of 53 per cent and composed of items known to be of significant discriminating power. The reliability coefficients



are .85

Objectives and content to be tested were drawn from an examination of widely used text books, state curricula, and samples of courses of study.

Even in India, as already referred to, attempts have been made in recent years to construct and standardize achievement tests in science. These have not been popularized. Some of the tests are in the regional languages, as for example, the one constructed and standardized by M.S. Thandavarkar, B.A., B.Sc., M.Ed., of the Karnatak University under the guidance of Dr. V.V. Kamat is in Kannada; and the other, an M.Ed. dissertation in general science submitted by Sri H.H. Pawar, B.Sc., LL.B., B.T., is in Hindi. The Psychological laboratory, Maharaja's College, Mysore constructed an Achievement Test in Elementary Science for V Form some years back. The test consists of 60 items of the Multiple choice type. Each item has four responses. This test has not been standardized. The test constructed by Sri M.S. Chandravarkar and published by Macmillan and Co., is intended to measure their knowledge of children between the ages of 8 and 18 in General Science in Bombay-Karnatak. It consists of 100 items. There are 20 items of the simple Re-call type, 18 items of the True False type, 15 items of the Association type, 15 items of the Alternative Response, 15 items



of the matching type, and 15 Alternative Response type. This was administered to 4,626 pupils. Norms, reliability and validity have been found out. Incidentally he has found out also the interest of children in the various branches of science.

The reliability of the test has been calculated by the split-half method. It is 0.89. The validity of the test has been calculated by comparing test scores with the examination marks. The co-efficient of correlation for various standards has been calculated. It lies between 0.37 and 0.66.

Sri Jagannath, B.Sc., B.T., M.Ed., Head Master, Sri Rama Krishna Vidyalaya has constructed in part fulfilment of his M.Ed. Course in the Institute of Education, Delhi, an achievement test in Physics; but it has not been standardized. He tried it on 200 students of the XI Standard of the City of Delhi. The test proposes to measure principles and basic concepts in Electricity and its every day applications. There are 25 items of M.P. choice type, 35 items of T.F. type, 29 items of problem and completion and 5 diagrams. He has found out the norms, reliability and validity of the test. The reliability is 0.65 and validity is 0.71.

Sri H.Venkataramaiah, B.Sc., B.T., M.Ed., Lecturer, Teachers' College, Mysore standardized an achievement test



in 1958 in General science Part I (Physics and Chemistry) for High School III student of Mysore State. The test consists of 30 items of T.F. type, 16 items of Multiple choice type, 20 items of the matching type, 18 items of the completion type, 7 items of the reasoning type and two diagram tests. He has found out the norms, reliability and validity of the test. The test has high norms of 54.77 and it is highly reliable and valid. It was administered to 2000 students selected from various strata of society. The investigator has given the minutest details regarding the standardization of a test in a very lucid manner. However, it would have been better if he had the test - items on Biology also. This would have given a complete picture of the attainment of the <sup>boys</sup> in General Science as a whole.

#### Nature of Achievement Test.

The attainment or acquired ability of a pupil in a subject of study is termed Achievement. The Achievement test measures the ability to do use or understand a certain thing based upon the knowledge, method, attitude, interests and skills a pupil acquires from instruction or experience. The kind of achievement to be measured depends upon the nature of the subject and the





various objectives of its teaching or learning.

There are two types of Achievement tests, General or *summary* tests and Diagnostic tests. "A General achievement test is one designed to express in terms of a single score a pupils relative achievement in a given field of achievement"<sup>1</sup> A diagnostic test on the other hand is designed to diagnose the deficiencies in learning and teaching in one or more areas of achievement. A battery of tests consists of different kinds of tests and each kind tries to find out the specific weakness, errors or gaps in attainment in a field of achievement, as for example a pupil's weakness in acquisition of knowledge, use of knowledge, (problem solving capacity) skill in performing experiments. Each of these tests is of the general achievement type and the whole test is diagnostic.

An achievement test may be constructed by a single teacher or a team of teachers for use in a class room. These are called informal tests. When a test is constructed carefully, systematically and scientifically in consultation with experts and experienced teachers and when it is tried and retried on a wide sample in a natural homely atmosphere and when certain characteristics, such as norms, validity, reliability, usability and predictability are determined, it is called a standardized test.

---

1. Hawkes: "Achievement Examination", page 23.



A standardized test has a wider objective than an informal test.

### Functions of Achievement Test:

The value of a testing programme depends upon the extent to which its results have been helpful in improving learning, instruction, guidance and administrative practices in schools. The achievement test, an important type of measurement, has all the useful functions referred to above.

### Influence On Learning:

An achievement test clearly indicates the type of learning or study procedures adopted by students. Even though Richardson and Stalankar<sup>1</sup> are opposed to the belief that an achievement test would always have a pedagogic value, this should not be an obstacle in finding out the influence of examinations on learning. Meyer<sup>2</sup> reported two studies on the type of examinations and memory, and type of examination and study procedures employed by students. The findings indicated that the type of examination does influence the nature of students' study. Johnson reported that testing stimulates learning and Spitzer concluded that testing helps in the retention of learning. We may therefore conclude that measurement influences -

---

1. Max D. Bugle Hart, "Encyclopedia of Education", page 411.

2. Ibid, page 411.



learning.

### Measurement and Instruction.

Any teacher is keen about the effects of his teaching. This he realises by the use of objective tests which throw some light both on the capacity of his students and his methods of teaching. The teacher would be able to gauge the good or bad points in his teaching methods. With the help of the test results he would also adopt the necessary remedial measures to achieve the necessary objective of the subjects taught.

### Measurement and Administration :

The healthy running and progress of an institution on the right lines is the responsibility of the administrator. It is his duty to see that proper methods of instruction are employed and the pupils achieve the various objectives of instruction. This can best be evaluated by the use of well constructed objective tests. These tests indicate not only the achievement level of the students, but also diagnose whether his suggestions if any have been followed or not.

### Achievement Tests and Counselling:

Counselling, as mentioned by John Darby,<sup>1</sup> "is the process in which information about the individual and about

---

1. John Darby, "Educational Measurement", page 68.



his environment is organized and reviewed in such a way as to aid him in reaching workable solutions to a variety of adjustment problems in the normal range of behaviour". School administrators are highly criticised for not identifying the abilities of pupils and for not directing them away from the fields in which they do not seem to have an aptitude. This can be easily overcome by the use of the new objective devices. The evaluation records of pupils show their worth and with the help of these their energies can be directed towards right ends. They can be counselled about the vocation or career they should choose in accordance with their attainments of certain skills, attitudes and concepts. They can also be guided with regard to the course of study they must choose for entry into a particular type of job or vocation.

#### Achievement Tests and Educational Placement:

Placing pupils who are normal for their group under the same group is a proper method of placement. Pupils alike in their chronological age, educational achievement, physiological, mental and social development must be placed under one group. The result of objective measurement can be used in determining the pupils placement in the group. Through the development of reliable grade and age norms based upon the achievement of groups of children in standardized tests, a valuable instrument for establishing a





grade line is made available. Achievement of children in standardized tests is made use of in admission into various kinds of colleges, in awarding scholarships and in the selection of personnel in the various branches of social activities. For example, the army alpha test was used for the purpose of selection of officers to man the armed forces.

### Principles for Achievement Test Construction:

The objective test construction, as any other work must be based on certain cardinal principles. The constructor should know the purpose his test should achieve. He must know what to measure and having fully and clearly understood this, he must think of the ways and means of measuring it. If he should know what to measure he must have a clear knowledge of the objectives of teaching and learning a particular course of study. It is not enough if he knows the broad objectives of such a course of study. He must have a clear insight into the required modification in behaviour such a study is likely to bring. Lindquist in this connection observes that "if measurement is to continue to play an increasingly important role in education, measurement workers must be much more than technicians. Unless their efforts are directed by a sound educational philosophy, unless they accept and welcome a greater share of responsibility for the selection and classification of educational objectives and unless they show much



more concern with what they measure as well as how they measure it, much of their work will go in vain".<sup>1</sup> Educational measurements have a great influence on the educational process and its improvement. The ability of the test constructor to know the situations in which tests are essential and useful or their influence on educational practices is as important as the ability in test construction. His test must be valid and dependable. What his test measurement must be of importance and significance and its use must exercise a desirable influence upon the aims, habits, attitudes and achievements of students, teachers, counsellors and school administrators. The first and foremost thing a test constructor must do is to formulate the objectives of his test or what it proposes to measure. This ~~is~~ implies what a particular field of study proposes to achieve. The objectives of teaching and measuring are interdependent. What then are the sources of getting the general objectives of teaching and learning a particular subject? According to Walter Monroe<sup>2</sup> there are four sources of formulating the objectives.

- 1) Anx analysis of the text book on the subject,
- 2) Analysis of the courses of study,
- 3) Analysis of teacher made tests,
- 4) Opinion of experts on the subject.

---

1. Lindquist: "Educational Measurement", page 158

2. Walter Monroe, "Encyclopedia of Education", page 1466.



The last of these sources is the most important one. Text books, courses of study, examinations and teacher made tests - all depend on expert opinion.

If text books are not written with due care taking into account the purpose of such a venture, examinations or tests constructed on the basis of these text books - measure just what is taught and not what should be taught. They do not take into account the modification in the behaviour of the pupil resulting from such instruction.

Objectives resulting from an analysis of the courses of study have an advantage over the previous type as they attach more importance to application of facts, principles and generalizations than factual knowledge.

An analysis of the teacher made tests gives us an idea of the opinion of a number of teachers about the importance to be given to a topic of study in a given field. Unless these tests keep in view the why and how of things, they are not helpful.

Dr. Benjamin S. Bloom, the College examiner of the Chicago University and expert on evaluation, conducted a number of evaluation workshops while in India in the year 1958.

He suggests - that a teacher or a test constructor



should first define the objectives of teaching a particular subject and should break down these into proper changes of behaviour expected in each pupil. To effect these changes of behaviour, learning situations have to be provided. After this comes the stage of test construction.

This means that an achievement test constructor focuses his critical attention on the objectives of education. This results in a systematic analysis, classification and restatement of the educational objectives. - Mere informational tests have been highly criticised by experts on measurement. Lindquist states "Good testing, as well as good teaching should penalize rote learning rather than place a premium upon it. A good test in this respect is one in which, among other things the constructor has assiduously avoided the use of text book language or of stereo-typed and catch phrases or pat verbalization likely to be acquired by the rote learner".<sup>1</sup>

The Iowa tests of Educational development constructed by Lindquist have the following titles for the individual tests (1) Ability to do quantitative thinking, (2) Ability to interpret Reading material in the social studies, (3) Ability to interpret reading material in the natural sciences, (4) Ability to interpret literary material, (5) Correctness in writing, (6) Understanding of the basic

---

1. Lindquist: "Encyclopedia of Education", page 1466.





social concepts, (7) Background in the natural sciences, (8) General Vocabulary, (9) Use of sources of information. These titles give us an idea of the important educational objectives and the types of tests in an over all evaluation programme.

### Some testing techniques.

It is quite beyond the scope of this work to have a complete and exhaustive discussion of the various types of tests. However, it is worth devoting a few pages to a brief treatment of these so as to give an idea about - their uses and limitations, and the various pitfalls that are to be carefully guarded against in constructing the test items.

#### 1) Alternate Response:

This is one of the most popular forms of the simple recall type. Alternate response items are those in which only two alternatives are presented to the pupil for his response. More often than not, it takes the form of True false statements requiring the pupil to establish the - correctness or otherwise of the given statement. Some times it requires the pupil to mark merely a 'Yes' or 'No' against each of the statements and some times involves the selection of the correct or the better one of the two responses presented as possible comparison in a given -

*Handwritten note:*  
 1/10/1962 11-11-12



situation. However the 'true - false' reigns supreme as the most widely used alternate response type. It involves a very simple method of response in the aligned answer positions of the test items. It is widely applicable in all subjects fields. It is generally believed to be easy to construct; however in actual practice, the elimination of ambiguities is often difficult, if not impossible, to accomplish. Yet, they can be used satisfactorily in many situations if they are constructed carefully enough to keep them free from ambiguity. They have the advantage of affording a wide coverage in a short period of time and serves a very useful purpose in the measurement of a functional type of instructional outcome. On the other hand guessing is more of a problem for this than for any other type and hence of little diagnostic value.

The following suggestions may be borne in mind while constructing the alternate response items.-

- 1) Avoid double negative statements for they serve no useful purpose and are often likely to needlessly confuse the pupil.

- 2) Do not use statements that are partly true and partly false. They add nothing to the test and intentionally or unintentionally take the form of 'catch' items.



3) Do not use specific determiners such as always, never, none, only, nothing etc. except with great care and as sparingly as possible.

4) Require answers in a simple but highly objective form.

5) Have a random distribution of true and false items and let there be no definite proportion of true and false items.

6) Make the crucial element in the question as obvious as possible to avoid ambiguity.

7) Avoid the use of text book language.

8) Avoid the use of general terms such as large, small, great, well-known, many, few etc., when fine distinctions are involved, or when the meaning is not obvious.

#### Completion:-

This is another form of the simple recall type and very commonly used. A completion item typically consists of a sentence or a paragraph from which key words have been omitted and blank spaces provided. The pupil is required to complete the statement by placing the proper words in the blank spaces. This is applicable to almost all achievement fields, easy to prepare and is likely to encourage more thorough study habits. On the other hand



it is over rated from the stand point of requiring understanding rather than rote memory, not highly objective unless great care is taken in construction and scoring, subject to over mutilation and time consuming.

The following suggestions are offered for the construction of completion items.-

- 1) Make each blank call for the completion of a single idea.
- 2) Avoid too many blanks.
- 3) Make all blanks the same length to avoid giving clues.
- 4) Avoid text book wording.
- 5) Avoid clues afforded by the requirement of grammatical consistency.
- 6) Make the statement sufficiently complete to enable the pupil to interpret the item correctly.
- 7) Omit only the key word or words.
- 8) Provide positions for responses ordinarily, at the end of the sentence.

#### Multiple Choice.-

The multiple choice type is a form of the recognition item type and has come to be 'the most popular form for standardized testing of recent years; and are increasingly coming into wide use for informal objective testing as well". A multiple choice item usually consists of an





incomplete statement followed by from three to five plausible alternatives that will complete the statement. The pupil is expected to choose the correct or the best response and to indicate his choice by an answer appearing in a column at the left or the right side of the test paper. It may be in the form of a question rather than a statement or may consist of three to five words, symbols or numbers from which the correct or the best one is to be chosen by the pupil. The multiple choice and its various forms are widely adaptable to different types of content as is the case with true false type. It is readily adaptable to the measurement of "discriminative power, inferential reasoning, interpretative ability, reasoned understanding, generalising ability and other types of outcomes deriving from the pupils ability to apply and use facts". But multiple choice items are not as easily constructed as some other types of tests because of the various technical problems involved requiring great care in the drafting of items..

Some of the important points to be remembered - while constructing multiple choice items, are.-

1) Use only one form of multiple choice in the same section of the test.

2) Use at least four or five possible responses in order to minimise chance successes.



3) Do not mix items with varying number of possible responses in the same test if the scores are to be corrected for guessing.

4) Make the alternatives plausible.

5) Have the alternative answers at the end of the statement.

6) Do not ordinarily use "a" or "an" to introduce the alternative answers.

7) Distribute the correct responses with approximate equality among possible answer positions.

8) Use a random occurrence of the correct responses.

9) Require the answers in a highly objective form.

#### Matching.-

Matching exercises may be considered as combinations of multiple choice items in such a manner that the choices are compound in manner. This type of test requires the matching of items placed in two or more columns. To prevent guessing extra items may be placed in the response column. The pupil is usually required to write the number of the matching item in a space provided for it

Matching exercises are widely applicable, easy to construct, fairly free from guessing and economical of space and time. But they are not suitable for measuring reasoning, understanding and judgement. They are susceptible



to clues and more adapted to measuring factual memory.

The following suggestions will be helpful in the construction of the matching type.

- 1) Provide only one correct matching for each item and make the items mutually exclusive.
- 2) Take care to see that there is consistency of grammatical form.
- 3) Maintain the consistency of classifications. Each of the two lists should contain items that are of the same category.
- 4) Make the matching sets neither too short nor too long from ten to fifteen pairings are probably optimum for balanced matching groups.
- 5) Arrange the items in random order in each test.
- 6) Have all the matching items on the same page.
- 7) Require the answers in a highly objective form.

#### Classification Test.-

To a casual observer, this seems to be very much like the multiple choice. In fact, most of the rules which apply to the construction of multiple choice items apply to this type of test as well. But a careful examination of the mental processes involved reveal that it is quite different from the multiple choice. The



classification test requires the pupil to discover a common relationship among four out of five words, which is not shared by the fifth which is to be eliminated from the group. This form of test is suitable for measuring the capacity for reasoning and judgement.

### Analogies-

This type of test involves to a high degree, rational thinking, reasoning<sup>and</sup>/judgement and the education of relationships and correlates. It consists of three words, two of which bear a definite relationship themselves. Not only the pupil is required to discover the relationship that exists between the two, but has also to find the correlate for the third. It discourages, as in the case of classification, rote learning and guessing and puts a premium on effective thinking.

### Enumeration.-

Enumeration is a form of the simple recall type in which the candidate is asked to enumerate properties, uses, and such other things. Enumeration test usually requires from three to five responses. This type of test is not much reliable as it lacks objectivity. However it is easy to construct and can be used to test factual knowledge.





Diagram Test.

Diagram test items are based on pictures and graphical representation. But they are not commonly used owing to various reasons. Good pictorial items can be used to measure useful skills, detection of - defects and critical observation.

\*\*\*\*



## CHAPTER -III

### Construction of Achievement Test in General Science:

Construction of an Achievement Test, as any other construction requires deep consideration of many important factor:-

1. Planning the test
2. Preparing the test
3. Trying out the test
  - a) Pre-try out
  - b) Try out
  - c) Item analysis
  - d) Administration of the final test

#### Planning:

This is a very important factor if a testing programme, is well planned, it saves wastage of time, overlapping and confusion. It must have well defined objectives, must specify the nature of the pupils to be tested, and indicate how the test scores would be put to use. ( "Good Tests do not just happen, nor are they the result of a few moments of high inspiration or exhaltation. On the contrary the process is calm deliberate, and time consuming .... it cannot be emphasised too strongly that the actual process of test construction must be preceded by careful planning if the test is to be successful. The test will be no better than the quality of the thinking

*Labanya*



that goes into it. In planning the test consideration must be given to the nature of the objective to be measured, the purpose it is to serve and the conditions under which it will be used".<sup>1</sup>

## 2. Preparing the Test.

Vaughn suggests, "an achievement test in courses of study to some extent at least be based upon what the pupils were actually taught rather than upon what some one may think should be taught".<sup>2</sup> The preparation of the test must take into account not only the content taught but consider also the behavioural modifications any programme of instruction is expected to bring about. That is to say an attempt should be made to ensure curricular validity. This then should keep in view the precise objectives to be measured and the areas of instruction from which they are to be measured. Hence in accordance with the above principles the following objectives were listed for measurement in this investigation.

1. Knowledge of fundamental concepts and principles of general science.

2. Reasoning and interpretation of scientific data.

3. Application of scientific knowledge.

1. Ross and Stanley: "Measurement in To-days' Schools" pages 140-141.

2. Vaughn: "Educational Measurement", by Lindquist, page 169.



#### 4. Critical observation.

These objectives were spread over the subject matter field as follows.

Physics	..	109
Chemistry	..	77
Biology	..	97
		<u>283</u>

Lindquist suggests, that in the construction of an achievement test, a number of text books in the subject be analysed to secure a tentative test of topics to be tested and the importance to be given to each topic. In addition to this a detailed study of the curriculum, the opinion of experts, a critical study of the examination papers and standardized tests in the field is inevitable. Hence in this investigation the following text books of Science prescribed by the department were analysed for the selection of topics for constructing test items.

1. High School Physics by J.G. Srinivasa Rao.
2. High School Physics by T.R. Parmeshwaran
3. High School Science by Gregory and Hodges
4. High School Chemistry by T.S. Krishna Iyengar
5. Text Book of Chemistry by T.S. Krishna Iyengar<sup>ma chay</sup>.
6. Introduction to Biology by N.G. Veerappa.
7. Introduction to Biology by Sundareshan

The syllabus in General science enclosed in the





Appendix A was critically analysed with regards the importance to be given to each topic. In addition to this a detailed study of the (1) public examination papers, (2) class examination papers, (3) standardized and semi-standardized tests, (4) notes of lessons of subject teachers, (5) class notes of students in the subjects was made. The opinion of the experienced teachers in the line was taken and the investigators experience as a teacher was made use of in constructing test items.

Last but the most important of all was to consider the reports of the Zakir Hussain Committee, Radhakrishna University Commission Report, J.P. Reddy's Report and the Lakshmanaswamy Mudaliar Committee's Report for the selection of the objectives and the type of examination to be adopted.

The task of writing the test items was taken up after the above mentioned consideration. "Item writing is an art. It requires an uncommon continuation of special qualities. It is mastered only through extensive and carefully supervised practice. As item writing is essentially creative, just as there can be no set formula for producing a good story or a good painting, so there can be no set of rules that will guarantee the production of good test items".<sup>1</sup> Though according to Eliot Robert there can be not set rules on item writing, it is done according to certain <sup>cardinal</sup> conditional principles.

---

1. Eliot Robert: "Educational Measurement", American Council on Education, N955, page 186.  
National Institute of Education  
Library & Documentation



The language must be simple, appropriate and within the understanding capacity of the pupils. The sentences must not be very long. Each item should allow not more than one answer. There should be no room for ambiguity. There must be minimum writing on the part of the students as far as possible answers must be secured on one side of the paper for easy scoring. "In test construction the prime requisite from the point of scoring is that those pupils reaction to the test which are to be scored be as simple, abbreviated and controlled as possible and the reactions have a definite spatial location".<sup>1</sup> The preliminary draft should include more items than needed in the final test. This facilitates culling out the appropriate from the inappropriate ones at a later stage. This necessitates that every type of tests must be one and a half times as long as the final one. As far as possible the ~~get-up~~ <sup>construction</sup> of the present test items is in conformity with the above mentioned principles. 283 items were constructed they were spread over the various types of tests as shown in the table below.

1	True false	..	60
2	Modified true false	..	30
3	Multiple choice	..	30
4	Matching	..	21
5	Completion	..	30
6	Classification	..	25
7	Analogies	..	20
8	Enumeration	..	31
9	Problem	..	15
10	Diagram	..	21



These items were subjected to the critical scrutiny of expert subject teachers and improved on the basis of their suggestions. These items were assembled into the form of a battery. Thus a battery of ten tests was prepared. Instructions were given at the beginning of each and samples were worked out.

The next step in the programme of test construction is to subject the test to a few trials. This is an important step in test construction and standardization. This way this can be standardized both for its content and method of administration in order to facilitate proper evaluation in its final form regarding its quality and the quality of pupil responses.

#### Trying out the Test.

The next step is to try the test on a representative sample of the examinees.

According to Jonard<sup>1</sup> the following purposes are served by a try out.

1. To identify weak or defective items and to reveal needed improvements. To identify ambiguous, indeterminate, implausible distractors, over difficult and over easy items.

2. To determine the difficulty of each individual item,

---

1. Herbert S. Conard: "Educational Measurement...." page 250.



in order that a selection of items may be made that will show item difficulty, appropriate to the purpose of the finished test.

3. To determine the discriminating power of each individual item.

4. To provide data to determine the number of items to be included in the final test.

5. To find out the time limits for the finished test.

6. To discover needed improvements in the mechanics of test taking in the directions of to examinees regarding the method of recording their responses.

7. To determine the inter-correlations among the items in order to avoid overlap in item selection.

#### Pre-Try-out.

By pre try out is meant a sample try out on a small sample of examinees for the purpose of finding out gross defects and short comings in the test with no idea of analyzing the data for individual items. It is just a step to find out how the pupils to react to the test. The sample may consist of half a dozen to 100 examinees, or a few adults who try to put themselves in the position of students for whom the test is intended.

This test was preliminarily tried on 40 students of





High School II Year of the Maharaja's High School, Mysore. (The time taken for answering the test was about one hour and 45 minutes). The opinion of the boys about the test was taken. They found the test to be interesting and not very difficult. In addition to this the test was administered to the 20 T.J.H. and 20 T.J.L. students of the Government Training College for Men, Mysore, who had studied the same topics. They also found the test to be interesting and of average difficulty.

#### Findings of the Pre-try-out.-

The test on the whole was found to be neither easy nor very difficult. There was no sign of disgust or indifference in the testees on the other hand a lot of interest was evinced by them in answering the test. Some vague and difficult items were detected. Out of the 283 items given 17 were discarded and the remaining 266 items were grouped under 10 sub-tests. Instructions were given at the beginning of each sub-test and examples were worked out. A copy of the booklet is given in the appendix B.

#### Try-out.

This trial of the test as has been already pointed out is to find out the various kinds of defects in the test items, instruction, type of administration, time length required, difficulty value and discriminating index of each item. Lindquist suggests that if one try out does not point out



all the defects present in a test it may be given two or more try outs. This means physical and financial burden. This can be avoided if necessary pre-cautions are taken to administer the test as far as possible under ideal conditions.

The sample of the try-out must be similar to the one intended for administering the final test. The sample - must be efficient that is to say, the sample must give valuable information about the population. The sample must be of adequate strength. But it is not the number tried that is important. The areas or schools from which it is drawn is of importance. A sample of 200 students from many schools drawn from different strata of society is - much better than taking the entire sample from one or two schools.

The precautions to be taken into consideration while administering the test, the conditions under which the test is tried and the directions to the examinees should be similar to these while administering the final test.

### Time Length

Sufficient time must be allowed for answering the test so that a great majority of the testees must be able to - answer almost all the items. The time required for answering the test items should not be usually longer than the



school period to avoid the difficulties in the problems of management.

### Motivation.

The active cooperation of the testees is essential if the testing programme is to be a success. To secure their cooperation they have to be motivated. There are various methods of motivating. Arthur Taxler<sup>1</sup> suggests that the pupils must be informed before-hand the purpose with which the test is given and the influence it will be having on the students.

### Guessing.

There is no agreement on the method to be adopted in directing <sup>pupils with regard to guessing</sup>. Some suggest that strict instructions must be given not to guess. If all follow this instruction the problem of guessing would be eliminated. But inspection of these instructions some would surely guess. This way those who also could have guessed correctly and got the - advantage stand to lose.

Some others suggest that every pupil must be asked to answer every item whether he knows it or not. This allows free and uniform guessing. After applying the - correction formula the true score can be gauged. This method makes students careless and adopt loose thinking.

---

1. Arthur Taxler: "Educational Measurement", page 345.



Guessing may be of two types, wild guessing and honest guessing. In wild guessing or dishonest guessing the guesser does not know the correct answer. He takes a chance by choosing some response wildly. Whereas in honest or intelligent guessing the pupil has partial knowledge and he guesses a right response with the help of his partial knowledge. Some suggest that pupils may be asked to guess intelligently. But it is not possible to know who have guessed wildly and who have done it intelligently. The application of the correction formula will not be justified in the case of those who have guessed intelligently.

#### Directions to the examinees.-

A study by Weidemann<sup>1</sup> and Melvens indicated that the nature of the directions may have considerable effect upon test scores. They tried five sets of directions - for giving tests involving true-false and indeterminate statements and found significant differences in the resulting scores. The directions must be clear and concise.

In this investigation the test (the battery of 10 sub-tests consisting of 266 items) was tried on 172 students of High School I Year at four High Schools in Mysore City, situated in different areas of the City, representing the different strata of society, the Maharaja's, Vidyavardhaka,

---

1. Weidemann and Melvens: "Educational Measurement", page 352.





Christ the King's Convent and the <sup>Good</sup> Shepherd's Convent.  
 The schools were requested well in advance to make proper arrangements for the conduct of the <sup>test</sup> on an examination level.

The cooperation of the Heads of the institutions and the teachers was made use of for smooth conduct of the test. The pupils were informed that they would be having a new experience in answering this new type of test and answering this would revise their portion in General Science and this would help them in their promotional examination which would come off in a couple of days.

Examples given at the beginning of each sub-test - were worked out on the board with their help. Thus the method of answering each type of test was explained. After this they were given the test booklets with strict instructions not to open them till they were so asked. They were asked to fill in the blanks on the facing sheet and read the instructions carefully. Instructions were - given that they should not guess as this would reduce - their score. They were given the opportunity of clarifying their doubts and <sup>cautioned</sup> ~~cautioned~~ that they should not ask any question after they begin to answer. They were asked to begin on hearing the signal 'start' A time piece was kept on the table. The time taken for general instruction and working examples on the board was noted to the



be half an hour. They were asked to note the time they start and finish each type of test. The total time taken by about 90 percent of the boys was found out to be about an hour and a quarter. The details of the time taken are given below.-

Statement showing the time taken for answering different Tests.

	No. of items.	Time taken.
1 True false	50	12 minutes.
2 Modified true false	30	10 "
3 Multiple choice	30	10 "
4 Matching	21	9 "
5 Completion	25	12 "
6 Classification	25	12 "
7 Analogies	18	9 "
8 Enumeration	31	6 "
9 Problem	15	8 "
10 Diagram	21	7 "
Total		85 "

Scoring:

Advice of Kenneth Bean<sup>1</sup> was followed in getting the answers noted in the booklet in a vertical column by pro-

---

1. Kenneth L. Bean: "Construction of Educational and Personnel Test".

*See Appendix*



providing a space on the left hand side of each question. This made scoring easy. Each right response was awarded one mark.

### Item Analysis.

After a test is administered the pupils' reaction to the test must be found out. Unless there is correct information is got about pupils reaction to an item its inclusion in the final test is not justified. The worth of a test depends upon the worth of the individual items in it. According to Walter Monroe<sup>1</sup> the effectiveness of an item in a general achievement test depends upon - three interrelated factors - (1) the validity of the item from the stand point<sup>of</sup> content, curriculum and educational objectives, (2) the discriminating power, (3) the difficulty of the item. The first of these factors has been dealt with under "Test construction" The other two are discussed here. The purpose of ~~effi~~ difficulty value and Discriminating index is to find out how hard an item is for the group tested and how well it discriminates between the strong and weak students.

### Difficulty Value.

The difficulty value of an item is the percentage of pupils that have answered the item correctly. When we say the difficulty value is 75 per cent it means that 75

---

1. Walter Monroe: "Encyclopedia of Education", page 1470.



per cent of the pupils have answered the item correctly. The greater the difficulty value the easier is the item. The difficulty value of all the items in the different sub-tests was calculated and tabulated as shown in the table.

### Discriminating Indexes.

The purpose of educational measurement is to grade pupils according to the degree of their achievement. This implies a great discriminating power on the part of the test. If the test as a whole should have this capacity every item in the test must boast of a high discriminating index.

Discriminative power of a test means that a different quality or response may be expected from different pupils. Superior pupils should answer the item correctly better than the inferior pupils. This assumption gives a procedure for finding of the discriminative index.

Some suggest that after scoring the test book lets they must be arranged in a descending order with the highest score at the top and lowest score at the bottom. The number of persons answering an item incorrectly in the lower 27 per cent, must be found out. The number of persons answering the same item incorrectly in the higher group must be found out. If the item really distinguishes between the good and the bad students then  $W_2 - W_1$  must be significant and positive. From the method both diffi-





culty value and discriminative efficiency can be found out by using the psychometric Research and Service Chart of Davis which is perfected by Tri B. Dasguptha. To use this table the minimum number of examinees must be 370. Since the number of examinees in this try-out is 172 the above method could not be used.

The other method is the whole group is divided into three groups after arranging the scored booklets in descending order of the obtained scores. The number of correct responses for each item by the pupils in the upper 1/3 is found out. This is compared with the responses that item secures from the lower 1/3 and the D.I. is calculated by using the formula.

$$D.I = \frac{U - L}{N/3}, \text{ where D.I. is the discrimina-}$$

tive index.

U = correct responses an item secure from the upper 1/3

L = correct responses - the lower 1/3

N = Number of examinees.

Comparison is made between the high and the low group. The item which secures a higher response from the upper 1/3 than the lower one discriminator well between the able and the backward pupils or the strong and weak knowledge. An item which has a zero dis-crimination between the response of these groups is useless. The item which receives



a higher response from the lower 1/3 than from the upper 1/3 has a negative discriminative. This is a detrimental item. It has to be either modified or discarded.

In this investigation the latter method was used. The scored book-lets were arranged in a descending order of the obtained scores. The response of the upper 1/3 for each item was found out. Similarly the response of each item in the lower 1/3 was found out. The result was arranged in the tabular form as given in the <sup>Appendix G,</sup> table below. With the help of these the difficulty value and the discriminating index were calculated.

#### Selection of Items for the Final Test.

after finding out the difficulty value and discriminating index of the test items, the next step is the selection of the items for the final test.

The determination of the optimum difficulty of the test item to be used in a standardized test is a problem of controversy. Some are of opinion that there must be roughly equal number of items at all levels from ~~or~~ very easy to very difficult. Some other maintain that apart from a few easy and a few difficult items the majority of the items must be of 50 per cent difficulty level.<sup>1</sup>

Writing in the journal of psychology P.K. Roy also

---

1. Green, Jogerson and Gurbrich: "Measurement" Evaluation in Secondary Schools" - page 90.



maintains that though in an ideal test each item must be of 50 per cent difficulty level it is not desirable that all items must be of this level. "It can be demonstrated statistically that an item passed by 50 per cent of a group discriminates between more pairs of persons than does an item passed by say 40 per cent or 60 per cent .....". "But it is not desirable, however, that items shall all appropriate the level of 50 per cent pass. We should try to include both easy and difficult items".<sup>1</sup>

( The common practice follows the latter suggestion of Sri P.K. Roy. Any item which is answered by all the pupils and any item which is not answered by all the pupils has no place for inclusion in a standard test.

On the above considerations 120 items were selected. Test items mostly lying between 20 per cent and 80 per cent difficulty level and having a discriminating index between .21 and .7 were selected. However a few items of a higher difficulty level and a lower discriminating index were also selected so as to safeguard the curricular validity.

The following table gives the types of tests and the number of items selected in each type.

---

1. P.K. Roy, Journal of Psychology, January 1952, pages 31-39.



Types of Tests and Items selected for the Final Test.

Type	No. of items in the Try-out.	No. of items selected for the final test.
1 True false	50	20
2 Modified true false	30	10
3 Multiple choice	30	10
4 Completion	25	10
5 Matching	21	10
6 Classification	25	10
7 Analogies	18	10
8 Enumeration	31	20
9 Diagram	21	20

Final Test form.

120 items were selected on the basis of item analysis, satisfying curricular validity, difficulty value, and discriminative index and they were arranged in the ascending order of difficulty. The next step was to fix the time limit for answering this test. The time taken to answer the try-out was found out for each sub-test and the test as a whole. It worked out to be 85 minutes for 266 items. Lindquist and Hawkes and Mann suggest that "Try to adjust time allowance, except in a rate, or speed test so that at least 75 per cent of the pupils will have time at least to consider all items in each section"<sup>1</sup>

---

1. Lindquist: "Achievement Examination", page 116.





Rush is more liberal, he favours time limits "so that 90 per cent can attempt all items within their power"<sup>1</sup> A time allowance of 45 minutes was fixed for the final test in accordance with the above two suggestions. The time fixed was purely meant for answering the test items after all the directions and instructions were given for each sub-test. Each item was subjected to the scrutiny of the science staff of the Teachers College and the Practising High School at a series of meetings.

The English version of the test was translated in to Kannada with the help of experienced science teachers. Two Kannada Pandits of the Practising High School scrutinised the Kannada version of the test with regards to spelling, grammar language and punctuation. Needed improvements and modification as per the suggestions of the Science teachers and language experts were effected before the items were drafted in the final form.

#### The Get up or the Format of the final Test.

According to Thorndike<sup>2</sup> the following considerations must be kept in view in the get up of a test.

- 1) Legibility, (2) Convenience in taking the test,
- (3) Convenience in scoring the test, and (4) attractiveness.

The test was got printed legibly both in Kannada and

---

1. G.M.Rush: "The Objective or New Type Examinations", Chicago, Foresman & Co., 1929, page 312.

2. Thorndike: "Personnel Selection", page 86.



English media.

The important directions were got printed in the cover page of the book let. Instructions given at the beginning of each statement were got printed in bold types. The items in each sub-test were arranged in the order of difficulty value.

The test was got up in the form of a book let. Each type of test should have run over only one page. But due to the practical difficulties this could not be adhered to. Any how one and the same item was not allowed to run over two pages. To prevent fatigue and monotony the number of the items in the test was restricted to 120 and the working time of the test was 45 minutes. Except in the case of Enumeration and diagram tests, in all other cases arrangement was made to get the pupil responses only on the left side of each item. Two examples were worked out at the beginning of each test and the method of working was explained. With the help of these examples and explanation the pupils were in a positive position to answer the test comfortably. Thorndike feels that this kind of working out examples is "one of the most effective techniques for guaranteeing understanding of the test task, or for discovering and correcting misunderstanding, if it is present".<sup>1</sup> A scoring key was prepared so that the score may remain the same whoever scores the test. The key was pre-

---

1. Thorndike: "Personnel Selection", page 264.



pared in such a way that it fits in the position of the students responses on the printed test page. With the help of the key, the answers could be scored easily. The <sup>test-</sup> answer book lets were got printed on a good paper. The test booklet gave an attractive look.

\*\*



## CHAPTER IV

### Administration of the Test.

#### The sample.

The efficiency of an investigation depends largely on a proper selection of the sample on which the test is to be administered. The term sample is used to designate the part of a population while the whole is called the Statistical universe or Statistical population. The statistical population in this investigation is all the high school II year students of the area of the old Mysore State. As it is almost impossible for a single investigator to launch on this stupendous task, a portion of this total population was selected. The portion selected is called the sample. This sample must represent the population truly. The method of selecting the sample is called the sample design or sampling process. The quality of the investigation depends upon proper sampling. In proper sampling every individual in the statistical population will have an equal chance of selections and the sample chosen gives a correct idea about the population.

If the sampling is defective "even the best statistical technique cannot make bad data yield valid results".<sup>1</sup> In drawing the sample design in this investigation the total number of pupils to whom the final test<sup>was</sup> to be administered

---

1. Garret, H.R., "Statistics in Psychology and Education", page 227.





had to be a representative of the whole group of High School II Year students, <sup>from</sup> the area of the old Mysore State. High School II Year students had to be selected, because they had studied the old syllabus, in I Year last year, and the present I Year students have a slightly, modified syllabus. The choice of schools and pupils had to be made with great care. There are many methods, of getting a representative sampling.

1. Random sampling
2. Stratified sampling
3. Area sampling
4. Accidental or uncontrolled sampling

#### 1. Random sample.

Random sampling "does not mean, that the sample has been chosen in an off hand, careless, or haphazard fashion. Instead it means that we rely upon a certain method of selection (called 'random') to provide an unbiased cross section of the larger group or population. The criteria - for randomness in a sample are met when (1) every individual in the population or supply has the same chance of being chosen for the sample; and (2) when the selection of one individual or thing in no way influences the choice of another." <sup>1</sup> Random sample can also be drawn by drawing similar and well shaken-up slips out of a hat. Random sampling is the best method of sampling. Even a systematic

---

1. Garret; "Statistics in Psychology and Education" page 202.



selection of an accurately listed population by taking every one fifth or every one tenth name written in an alphabetical order gives approximately a random sample.

## 2. Stratified - Random Sampling.

This is also called controlled sampling. It is a technique designed to ensure representativeness to avoid bias by using a modified random sampling method. It consists of two or more random samples drawn from two or more sub-divisions or strata of the total population. The different strata or sub-divisions are based upon Socio-economic status, education, skin colour, and nat<sup>ion</sup>ality background.

## Area Sampling.

This is a new method of designing samples. In this method the entire area is sub-divided into small sections each of which is a sampling unit, and certain of these area units are drawn at random to constitute a sample.

In this investigation the sample design was drawn according to Stratified Random sampling. The total area of the old Mysore State was studied under three strata - the urban, the rural and the industrial. Mysore and Bangalore were considered urban, Mandya, Bhadravati and K.G.F. industrial and the other parts as belonging to the rural group. Schools in the different areas mentioned above





1	2	3	4	5	6
14	Sarvodaya High School	40	..	40	
15	Milaganga High School	40	40	80	
16	Govt. Boys High School	40	40	80	
17	Thamaraingar. Municipal High School	40	40	80	
18	971 Shivarathraswara High School	40	40	80	
19	Renjungud Govt. Boys High School	40	40	80	
20	Krishnaraja- Nagar. District Board High School	..	80	80	
21	Saileswara Municipal High School	..	80	80	
22	Pandavapura Vijaya High School	..	80	80	
23	Srirangapatna. Municipal High School	..	80	80	
24	<u>Industrial</u>				
	Mandya Govt. Boys High School	40	40	80	
25	St. Joseph Convent High School	40	40	80	
26	Mysugar High School	..	80	80	
27	Municipal High School	..	80	80	



**Distribution of the Sample number according to Regions and Schools and Medium of Instruction.**

No.	Region	Name of the School.	Student Population...		TOTAL
			English Medium.	Kannada Medium.	
1	2	3	4	5	6
1	<u>Mysore</u>	Ramakrishna Vidyalaya	40	...	40
2		Vidyavardhana High School	40	40	80
3		Maharani's High School	40	40	80
4		Christ The King Convent	40	40	80
5		St. Philomena's High School	40	40	80
6	<u>Bangalore</u>	Govt. Boys High School, Malleswaram	40	40	80
7		Govt. Central High School	40	40	80
8		Govt. Vani Vilas Institute	40	40	80
9		National High School	40	40	80
10	<u>Bijapur</u>	Tasker Corporation High School	40	..	40
11	<u>Tumkur</u>	Govt. Boys High School	40	40	80
12		Empress Girls High School	40	40	80
13		Aryan High School	40	40	80



were listed and selected by Random selection With the help of the Fisher's Table and keeping in view the number of students to be drawn into the sample from each area and the type of management i.e Government, Private and local bodies.

It was decided to draw a sample of roughly about 30 per cent from the urban area, about 10 per cent from the Industrial area and about 60 per cent from the rural area. It was decided to have 10 schools from the urban area representing different strata of society, four schools from the Industrial area and 13 schools from the rural area. This number had to be spread over schools under different managements. The number was spread as shown below.

Managements.	Urban		INDUSTRIAL		Rural		Total.
	Boys	Girls	Boys	Girls	Boys	Girls	
Government	2	2	1	.	3	1	9
Local Bodies	1		1		5		7
Private	4	1	1	1	4		11
Total	7	3	3	1	12	1	27

The schools in different areas and different management were selected by Random selection as mentioned earlier. The sample selected was distributed over the various schools as shown in the Table on page 72 (a)

Ross<sup>1</sup> recommends the consideration of the following questions for ensuring proper administration of the test.

1. Ross: "Measurement in To-day's Schools", page 225.



1. When should the test be administered?
2. Who should administer the test?
3. What is the correct procedure to follow?

1. When should the test be administered?

This test had to measure the achievement of High School II Year pupils in the first year portion of General Science. This was not taken up during the early period of the academic year as the pupils responses would not be normal and as they would be disinclined to take the examination soon after the summer holidays. The best time in the opinion of the investigator was when they were ready for the promotional examination. Therefore the last week of January was regarded the optimum period for the test to commence. The test programme commenced from the 23rd of January and it lasted till the 13th of February.

This was quite in consonance with the opinion of Ross<sup>1</sup> who says "There is also the fact that many studies have shown a considerable decline in knowledge at the end of summer vacation. This would seem to favour giving the test at the end of the school year when the pupils status is more normal"

2. Who should administer the test?

In the ordinary testing programme it is enough if the class room teacher administer the test. When the tests are

---

1. Ross: "Measurement in To-day's Schools", page 226.



used for purposes of research, or when they are used to compare one grade, class or school with <sup>or</sup> other they should be given by one person or a group of persons specially trained for this purpose. In the present investigation the investigator himself administered the test in all the schools to ensure uniformity of procedure. However the willing help of the teachers and Head Masters was made use of for the healthy conduct of the test.

### 3. What procedure should be followed?

Ligon<sup>1</sup> argues that the conditions for the test must be favourable. The test should be given in the familiar environment of the pupils own class rooms. The test should be given at regular class time without permitting to run over the lunch time or play time. He is even against having the test administered just before - or after an important event in the school like a holiday, a school party or an athletic contest. He emphasizes that unnecessary distraction and interruptions should be avoided. The words "Test going on. Please do not disturb" should be written on a card and should be hung outside the class room. The time limit should be maintained. When the test is in progress the examiner must be alert to see that pupils neither help nor hinder each other nor are distracted by external disturbances. According to Ligon<sup>2</sup> the necessary requirements of the group

---

1. Ligon: "Measurement in To-day's School", page 228.

2. Ibid. 230.



testing are "That all the subjects understand the instructions, that they all work throughout the assigned time at their optimum level of achievement, that they do not quit trying or omit any section of the test, that examiners - give instructions adequately and in a stimulating effective tone of voice - not a dull bored monotone - and that proctors are observing every movement of the group, stimulating lagging souls, inhibiting wandering eyes and detecting failure to instructions". However when a pupil forgets any instruction he should be permitted to raise his hand and get the necessary help.

#### Administration of the Test.

Programme:- The administration had to be carried according to certain programme to avoid unnecessary inconveniences and impediments in the work. A programme for conducting the test in the various schools selected was chalked out with the following details.-

Date, time and place of conducting the test and the number of students required in either of the media of instruction. A copy of the programme is found in Appendix D

Intimations were sent to the respective heads of the institutions well in time requesting them for permission - and necessary help. The letter of request contained the following details.

1. Date and time of administering the test.





2. Time required for work.

3. Number of candidates required in each medium of the class.

4. Information required about each candidate taking the test.

a) The test marks and the first terminal marks of the candidates in general science.

b) The names of 10 best and 10 worst pupils as per the estimate of the subject teachers.

A copy of the proforma is found in Appendix C.

The test was administered in January - February 1961, in all the 27 schools as per schedule.

The test was administered to 2023 students. Of this 1501 were boys and 522 were girls. The distribution of the number in English medium and Kannada medium was as follows.-

English Medium

Kannada Medium.

845

1178

The administration of the test was carried in person as already referred to. The suggestions of Ligon quoted above were kept in view and the method of motivation, directions, instructions and securing examination conditions for the test were the same as followed during the try-out. During this stage there was a slight modification in the method.



of motivation. The pupils were told that their promotional examination was fast approaching. They were informed that they had to answer a <sup>new</sup> set type of questions which are very easy and interesting. Answering <sup>these</sup> ~~revis~~ would revise the General Science portion of the previous year. The method of answering the different types of tests were explained by working out the examples given at the beginning of each type of test on the black board. Their doubts were clarified. The method of recording the answer was also explained. In short the advice of McCall "An ounce of demonstration is worth a pound of words -- probably due to primordial practice, children, not to mention adults can initiate better than they can comprehend and follow linguistic directions - - - . Demonstration has still further advantage of securing better attention especially from the young children".<sup>1</sup> was followed.

The students were asked to carefully fill in the blanks on the facing sheet. The directions given on the facing sheet were explained to them. The total time required for working out samples and explanation was 15 minutes. They were asked to begin at the signal "start" and "stop" answering at the signal "stop" 45 minutes were allowed for answering all the test items.

#### Scoring of the Test.

"The results of a test possessing scorability should

---

1. W.A. McCall: "Measurement", page 81.



should be obtainable in as simple, rapid, and routine a manner as is commensurate with their importance".<sup>1</sup> There are many methods of securing accurate scoring. In America where tests are administered to many thousands of students they make use of machine scoring. The International Test Scoring Machine scores pupils' answer sheets by means of an electrical current flowing through the lead deposited by the pupils electrographic pencil on the answer sheet.

#### Hand Scoring.—

There are many types of Hand scoring keys. The strip keys, cut out stencils and transparent stencils. In this investigation the strip key method was used. Answers for each page of the test book let were written in red ink and these were pasted on a card board sheet. The answers were spaced in such a way that they corresponded in spacing with the items of the test. Except in the case of enumeration and the diagram tests the answers were secured on the left hand side of each page in a columnar manner. The key was placed by the side of each page and the items of that page were scored.

As there is complete objectivity in scoring an objective test, even a clerk or a student can score a test as there will be no room for variation when the scoring is as per the key provided. In spite of these facilities of gett-

---

1. Green, Gerburich and Jegyson: "Measurement and Evaluation in Secondary Schools", page 80.



ing the test scored by a clerk in order to avoid a re-check the investigator himself undertook the scoring of all the 2023 booklets. A score of one mark was allowed for each correct response except in the case of the enumeration and the diagram tests where a score of half a mark was given for each correct response. Each correct response was ticked off with a pencil. A cross mark was put against each wrong response.

The total number of odd and even items answered correctly were noted. The correction formula  $C = R - W$  was applied to the True False Test. This was not applied to the other tests as there is difference of opinion about effecting correction to other kinds of tests. Lindquist<sup>1</sup> is of opinion "The frequency with which a certain wrong response is selected will depend upon the degree to which the item writer succeeded in making that response highly plausible in the light of whatever (inadequate) knowledge or ability the examinee does possess. If the item writer achieved his aim the wrong responses will always appear more plausible than the correct response to the examinee who does not possess the desired knowledge or ability" He is of opinion that the greater the number of choices per test item, the less important it is to correct for guessing.

The correct scores of each individual item were found out for calculating reliability by the method of Rational

---

1. Lindquist: "Educational Measurement", page 366.





equivalences.

The raw scores thus obtained were tabulated into different groups.

The scores of the pupils of various schools are given in the appendix//.



## CHAPTER - V

### Standardization of the Test.

#### Statistical Treatment:

After the tests have been scored and checked the next step is to analyse and interpret the test results. Interpretation and analysis go hand in hand. Analysis is of no use without interpretation, and interpretation is impossible without analysis. Analysis is of two types. (1) Statistical, (2) Graphical. Classification and tabulation of the data is essential for both.

In this investigation the scores were tabulated into frequency distributions of the various groups, total, urban, rural, Industrial, Boys and Girls and English and Kannada Medium, and the measures of (1) Central Tendency, (2) Measures of variability and (3) Divergence from Normality are calculated.

The results are represented graphically also. Percentile norms have been estimated. Validity and Reliability of the test are found out.

#### Measures of Central Tendency:-

The value of a measure of Central Tendency is two fold. It is a single measure which represents all the scores made by the group. It gives a concise description



of the performance of the group as a whole. With the help of a measure of central tendency we can compare the performance of many groups of the same standard in a field of Achievement.

The measures of central tendency for various groups have been calculated and their reliability found out. The means of the different groups have been compared and the significance of any existing difference has also been estimated.

#### Measures of Variability.

Having found out the measures of central tendency the spread or scatter of the separate scores around their central tendency has to be calculated. The spread or scatter around the central tendency is called variability. If a group is homogeneous, that is, made up of individuals, of nearly the same ability, most of the scores will fall around the same point on the scale, the range will be short and the variability will be small. But in a heterogeneous group there will be a wide spread of scores.

The different measures of variability for different groups have been calculated and their reliability estimated.

#### Measuring Divergence from Normality:

"Measurements of many natural phenomena and of many



mental and social traits under certain conditions tend to be distributed symmetrically about their means in proportions which approximate those of the normal probability distribution".<sup>1</sup>

To find out whether our measurement is a true sample of the achievement in question of the whole population the scores obtained in a test or examination are represented in the form of a frequency polygon. After smoothing the degree of symmetry of the resulting curve is noted. A normal curve is bilaterally symmetrical about a point. The mean, mode, and median all coincide and there is perfect balance between the right half and <sup>the</sup> left half of the figure.

When the three measures of central tendency do not coincide, the balance or centre of gravity is shifted to one side or <sup>the</sup> other. This appearance is termed Skewness. This is a divergence from Normality. The nature of Skewness and whether it is significant or not is found out by the two formulae -  $SK = 3(\frac{\text{Mean} - \text{Median}}{\text{Standard Deviation}})$  and a measure of skewness in terms of percentiles.

$$SK = \frac{P_{90} + P_{10}}{2} - P_{50}$$

In this investigation the Skewness was calculated for the smoothed frequency polygons of the various groups

---

1. Garret H.D. "Statistics in Psychology and Education", page 92.





and whether it is significant or not was also found out. Except in the case of the English medium group and the Rural boys group, the skewness was insignificant. That is to say there was no divergence from normality in the remaining ten groups of study. Even in the above two groups it was of a low order. The one possible explanation that can be given for this divergence being significant in the English medium group is, the language difficulty. It takes some time for pupils to understand instructions in English. As they are used to instructions in Kannada medium in the middle school a sudden change in the high school classes tells upon proper understanding of instruction.

### Kurtosis.

This refers to the peakedness or flatness of a frequency distribution when compared with the normal curve. A frequency distribution which is more peaked than the normal is 'leptokurtic', one flatter than the normal 'platykurtic'. A normal distribution is mesokurtic. Scores made by small and homogeneous groups are likely to yield leptokurtic distributions; while scores from large and heterogeneous groups are more likely to be platykurtic. The kurtosis for the various groups has been calculated and its reliability determined.



### Graphical representation.

Graphical representation of an educational data is a valuable supplement to statistical analysis. D. Hubbard<sup>1</sup> remarks "there is a magic in graphs". He describes the dynamic role of graphs as words have wings, but graphs interpret. Graphs are pure quantity stripped of verbal sham, reduced to dimension, vivid and unescapable.

The <sup>findings</sup> findings of this investigation are represented graphically. Frequency polygons have been drawn for all the groups of study. To iron out chances of irregularities and also to get a better notion of how the figure might look if the data were numerous, the frequency polygons are smoothened as per the smoothed frequencies calculated for each group given in the frequency table of the particular group. Best fitting N.P. curves have been super imposed on the frequency polygons representing three broad groups urban, rural and industrial.

The method of super imposing the best fitting normal curve of the same N, M, and SD as the actual distribution requires a little explanation. The first step is to compute the height of the maximum ordinate ( $y_0$ ) or the frequency at the middle of the distribution. The maximum ordinate can be determined from the equation<sup>2</sup> of normal curve is -

- 
1. D. Hubbard: "Measurement in Today's Schools", Quoted by Ross, page 247.
  2. Garret: "Statistics in Psychology and Education", page 94.



curve is 
$$y = \frac{N}{\sigma \sqrt{2 \pi}} e^{-\frac{x^2}{2 \sigma^2}}$$

in which

$x$  = scores (expressed as deviation from the mean)  
laid off along the base line or  $x$  axis

$y$  = the height of the curve above the  $x$  axis, i.e.,  
the frequency of a given  $x$ -value or the number  
achieving a certain score

$N$  = Number of cases

$\sigma$  = Standard deviation of the distribution

$\pi$  = 3.1416

$e$  = 2.7183 (base of the Napierian system of  
logarithms)

When  $x$  in this equation is put equal to zero (the  $x$  at the  
mean of the normal curve is 0) the term  $e^{-\frac{x^2}{2 \sigma^2}}$  equals

1.00 and  $y_0 = \frac{N}{\sigma \sqrt{2 \pi}}$

the  $\sigma$  used in this equation is in interval units,  
since the units on the  $x$  axis are in terms of class intervals.<sup>1</sup>

The position of the mean for the best fitting curve  
is calculated by subtracting the obtained mean of the group  
from 49.5 *and marking the distance along the  $x$  axis*  
~~and multiplying the result by the class interval.~~  
Having calculated  $y_0$  the other ordinates are calculated with  
reference to Garret's Table B.<sup>2</sup>

---

1. Garret; "Statistics in Psychology and Education",  
page 102.

2. Ibid, page 424.



Ordinate at	$M \pm 0.0$	$= 1000.00 \times y_0$	$= 1 \times y_0$
"	$M \pm 0.5$	$= .88250 \times y_0$	$= .88 y_0$
"	$M \pm 1.0$	$= .60653 \times y_0$	$= .61 y_0$
"	$M \pm 1.5$	$= .32465 \times y_0$	$= .32 y_0$
"	$M \pm 2.0$	$= .13534 \times y_0$	$= .14 \times y_0$
"	$M \pm 2.5$	$= .04394 \times y_0$	$= .04 \times y_0$
"	$M \pm 3.0$	$= .01111 \times y_0$	$= .01 \times y_0$

The following tables give the data used for drawing the best fitting normal curves for the different groups.

A look at these curves indicates how well the smoothed frequency curves compare with the best fitting normal curves.

Ogives have also been drawn for the comparison of various groups and for calculation of the percentile norms, in the case of the entire group





Entire Group.

x	$47.17 = \frac{3}{47.17}$	$\pm .5\sigma$	$\pm 1\sigma$	$\pm 1.5\sigma$	$\pm 2\sigma$	$\pm 2.5\sigma$	$\pm 3\sigma$
y	$y_0$	$.88y_0$	$.61y_0$	$.32y_0$	$.14y_0$	$.04y_0$	$.01y_0$
	464.8	410.2	281.9	150.9	63.0	20.4	5.2
Small Divns. on y axis	<del>77.5</del> 58.1	<del>68.4</del> 51.3	<del>47.0</del> 35.2	<del>25.2</del> 18.9	<del>10.5</del> 7.9	<del>3.4</del> 2.6	<del>0.9</del> 0.7

Rural

x	47.2	$\pm .5\sigma$	$\pm 1\sigma$	$\pm 1.5\sigma$	$\pm 2\sigma$	$\pm 2.5\sigma$	$\pm 3\sigma$
y	$y_0$	$.88y_0$	$.61y_0$	$.32y_0$	$.14y_0$	$.04y_0$	$.01y_0$
	210.1	184.9	128.2	67.2	29.4	8.4	2.1
Small Divns. on y axis	142. 42.02	36.98	25.64	13.44	5.88	1.68	.42

URBAN

x	47.17	$\pm .5\sigma$	$\pm 1\sigma$	$\pm 1.5\sigma$	$\pm 2\sigma$	$\pm 2.5\sigma$	$\pm 3\sigma$
y	$y_0$	$.88y_0$	$.61y_0$	$.32y_0$	$.14y_0$	$.04y_0$	$.01y_0$
	197	173.16	120.17	63.04	27.58	7.88	1.97
Small Divns. on y axis	39.4	34.64	24.04	12.62	5.52	1.58	0.4

INDUSTRIAL

x	48.03	$\pm .5\sigma$	$\pm 1\sigma$	$\pm 1.5\sigma$	$\pm 2\sigma$	$\pm 2.5\sigma$	$\pm 3\sigma$
y	$y_0$	$.88y_0$	$.61y_0$	$.32y_0$	$.14y_0$	$.04y_0$	$.01y_0$
	60.39	53.15	36.84	19.32	8.46	2.42	0.60
Small Divns. on y axis	50.3	44.3	30.7	16.1	7.05	2.02	0.5



# Frequency Distribution - Entire Sample

c.i	M.P.	f	x	fx	$fx^2$	$\sum (x-M)^2$	$f \mid d$	c.r	of r	s.f.	s.e.f.
1	2	3	4	5	6	7	8	9	10	11	12
90-99	94.5	4	5	20	100	47.22	188.88	2023	100	14.3	999
80-89	84.5	39	4	156	624	37.22	1451.58	2019	99.8	72.7	99.2
70-79	74.5	175	3	625	1575	27.22	4763.50	1980	97.9	173.3	95.6
60-69	64.5	312	2	624	1248	17.22	5372.64	1805	89.2	281.3	87
50-59	54.5	387	1	387	387	7.22	2794.14	1493	73.8	371.7	72.6
40-49	44.5	416	0	...	...	2.78	1156.48	1106	54.7	287.0	54.2
30-39	34.5	340	-1	-340	340	12.78	4345.20	690	34.1	336	35.4
20-29	24.5	252	-2	-504	1008	22.78	5740.56	350	17.3	226.3	18.8
10-19	14.5	87	-3	-261	783	32.78	2861.86	98	4.8	116.7	7.5
0-9	4.5	11	-4	-44	176	42.78	470.58	11	0.5	32.1	1.8
		0							0	3.7	0.2

$N=2023$      $\sum fx = 563$      $\sum fx^2 = 6241$      $\sum f \mid d = 29135.42$



Measures of Central Tendency, Variability and Divergence  
From Normality.

$$\begin{aligned}\text{Mean} &= A. M + J.1 \quad c = \sum fx/N = 563/2023 \\ &= 44.5 + .278 \times 10\end{aligned}$$

$$\begin{aligned}&= \underline{47.28} \\ \text{Median} &= L + \frac{\frac{N}{2} - F}{f_m} \times i\end{aligned}$$

$$N/2 = 2023/2 = 1011.5$$

$$F = 690$$

$$N/2 - F = 1011.5 - 690$$

$$= 321.5$$

$$L = 39.5$$

$$\begin{aligned}\text{Median} &= 39.5 + \frac{321.5}{416} \times 10 \\ &= 39.5 + 7.73 \\ &= \underline{47.23}\end{aligned}$$

$$\text{Mode:-} =$$

$$\text{Crude Mode} = 44.5$$

$$\begin{aligned}\text{True Mode} &= 3 \text{ Md} - 2 \text{ Mean} \\ &= 47.23 \times 3 - 47.28 \times 2 \\ &= 141.69 - 94.56 \\ &= \underline{47.13}\end{aligned}$$



Quartile Deviation:-

$$\begin{aligned}
 Q_1 &= L + \frac{N/4 - F}{f_m} \times 10 & N/4 &= 2023/4 = 505.75 \\
 & & F &= 350 \\
 &= 29.5 + \frac{155.75}{340} \times 10 & N/4 - F &= 505.75 - 350 \\
 &= 29.5 + 4.58 = 34.08 & &= 155.75 \\
 & & L &= 29.5
 \end{aligned}$$

$$\begin{aligned}
 Q_3 &= L + \frac{3N/4 - F}{f_m} \times 10 & 3N/4 &= 1517.25 \\
 & & F &= 1493 \\
 &= 59.5 + \frac{24.25}{312} \times 10 & 3N/4 - F &= 1517.25 - 1493 \\
 &= 59.5 + 0.78 & &= 24.25 \\
 &= 60.28
 \end{aligned}$$

$$\begin{aligned}
 Q &= \frac{Q_3 - Q_1}{2} = (60.28 - 34.08)/2 \\
 &= 26.2/2 = \underline{13.1}
 \end{aligned}$$

Mean Deviation:-

$$\begin{aligned}
 M.D &= \frac{\sum f |d|}{N} = \frac{29135.42}{2023} \\
 &= \underline{14.42}
 \end{aligned}$$

Standard Deviation:-

$$\begin{aligned}
 S.D &= 1 \times \sqrt{\frac{\sum fx^2}{N} - c^2} \\
 &= 10 \sqrt{\frac{6241}{2023} - (.28)^2} \\
 &= 10 \sqrt{3.085 - .0784} \\
 &= 10 \sqrt{3.0066} \\
 &= 10 \times 1.734 = \underline{17.34}
 \end{aligned}$$





Skewness:-

$$SK = \frac{P_{90} + P_{10}}{2} - P_{50} \quad \begin{array}{l} 10\% \text{ of } 2023 \\ = 202.3 \\ F = 98 \end{array}$$

$$P_{10} = L + \frac{202.3 - 98}{252} \times 10$$

$$= 19.5 + \frac{104.3}{252} \times 10$$

$$= 19.5 + 4.14 = 23.64$$

$$P_{90} = 69.5 + \frac{1820.7 - 1805}{175} \times 10 \quad \begin{array}{l} 90\% \text{ of } 2023 \\ = 202.3 \times 9 \\ = 1820.7 \\ F = 1805 \end{array}$$

$$= 69.5 + \frac{15.7}{175} \times 10$$

$$= 69.5 + 0.9 = 70.4$$

$$SK = \frac{1}{2} (70.4 + 23.64) - 47.23$$

$$= \frac{1}{2} \times 94.04 - 47.23$$

$$= 47.02 - 47.23 = \underline{-0.21}$$

Kurtosis:-

$$Ku = \frac{Q}{(P_{90} - P_{10})}$$

$$= 13.1 / (70.4 - 23.64)$$

$$= 13.1 / 46.76$$

$$= \underline{0.280}$$



Reliability of Mean, Median, Standard Deviation, Percentile  
Skewness and Kurtosis:

Reliability of Mean:-

$$\text{Obtained Mean} = 47.28$$

$$\sigma = 17.34$$

$$\text{S.E. of Mean or } \overline{M} = \frac{\sigma}{\sqrt{N}} = \frac{17.34}{\sqrt{2023}} = .39$$

The fiduciary probabilities is 0.95 *hal*.  
the true mean lies in the interval

$$M \pm 1.96 \overline{M} \text{ or } M \pm 1.96 \times .39$$

$$\text{or } 47.28 \pm 0.76 \text{ or } 46.52 \text{ and } 48.04$$

The true mean lies between  $M \pm 2.58 \overline{M}$  or

$$47.28 \pm 2.58 \times .39 \text{ or } 47.28 \pm 1.0$$

or 46.28 and 48.28 at the .01 level of confidence.

Therefore the sample mean of 47.28 with the S.E. of 0.39 is highly stable and deserving of great confidence.

Median:-

$$\text{S.E. of Median} = \overline{M}_{\text{in}} = \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 17.34}{\sqrt{2023}}$$

$$= 21.727/46 = .48$$

Therefore the true median lies between  $47.23 \pm 1.96 \times .48$  at .05 level and between  $47.23 \pm 2.58 \times .48$  at .01 level of confidence i.e. between  $47.23 \pm 0.94$  and  $47.23 \pm 1.24$ . This narrow range indicates high stability in the computed median.

1

Standard Deviation:-

$$S.E \quad \text{or} \quad \sigma_{\bar{x}} = \frac{.71\sigma}{\sqrt{N}} = \frac{.71 \times 17.34}{\sqrt{2023}} = 0.27$$

Therefore the limits of accuracy are

$$17.34 \pm 1.96 \times .27 \quad \text{or} \quad 17.34 \pm 0.53$$

or 16.81 and 17.87 at .95 confidence level

$$\text{and } 17.34 \pm 2.58 \times .27 \quad \text{or} \quad 17.34 \pm .70$$

or 16.64 and 18.04 at .99 confidence level.

Skewness:-

S.F. of Percentile Skewness:-

$$\sigma_{sk} = \frac{0.5185 D}{\sqrt{N}}, \quad \text{where } D = P_{90} - P_{10}$$

$$= 0.5185 \times 46.76 / \sqrt{2023} \quad P_{90} = 70.40$$

$$= .54 \quad P_{10} = 23.64$$

Therefore D = 46.76

The deviation from the normal in this sample

is - 0.21 Dividing this by 0.54, we get the critical ratio

$$\text{i.e. G.R} = \frac{-0.21}{.54} = \frac{-0.21}{.54}$$

$$= -0.39$$

$$= -0.39$$

This is far short of 1.96 at .05 and of 2.58 at .01 confidence levels of significance. Hence the obtained skewness of -0.21 is quite negligible and the distribution is almost perfectly symmetrical.



Kurtosis:-

Obtained Kurtosis = 0.28

This deviates from 0.263 for the normal by

$.28 - .263 = 0.017$  which shows that the distribution tends to be platykurtic.

$$\begin{aligned} \text{SE of the percentile measure of Kurtosis} &= \sigma_{\bar{K}_u} = \frac{.28}{\sqrt{N}} \\ &= \sigma_{\bar{K}_u} = \sqrt{\frac{.28}{2023}} = 0.006 \end{aligned}$$

Therefore  $Z.R = \frac{.017}{.006} = 2.83$  which is greater

than 2.58 at the .01 confidence level and still greater

than 1.96 at .05 confidence level. Hence the distribu-

tion is really more flattened than the normal. This is

explained by the fact that there is a wide distribution of

cases in the middle range -  $Q = 13.1$









# Frequency Distribution - Rural

c.i	M.P.	f	x	fx	fx <sup>2</sup>	$\sum (x-M)^2$		c.f	c% f	s.f.	s.c.f
						1	2				
1	2	3	4	5	6	7	8	9	10	11	12
		0								0	
90-99	34.5	0	5	0	0	47.33	0	891	100.0	4.3	100
80-89	34.5	13	4	52	208	37.33	485.29	891	100.0	27.3	99.5
70-79	34.5	69	3	207	621	27.33	1885.77	878	98.5	77.3	96.4
60-69	64.5	150	2	300	600	17.33	2599.50	809	90.8	132.6	87.8
50-59	54.5	179	1	179	179	7.33	1312.07	659	74.0	171.3	72.9
40-49	14.5	185	0	...	0	2.67	493.95	480	53.9	166.7	53.7
30-39	34.5	136	-1	-136	136	12.67	1723.12	295	33.1	145.3	34.9
20-29	24.5	115	-2	-230	460	22.67	2607.05	159	17.8	97.7	18.6
10-19	14.5	42	-3	-126	378	32.67	1372.14	44	4.9	53	7.6
0-9	4.5	2	-4	-8	32	42.67	85.34	2	0.2	14.7	1.7
		0								0.7	.1

N = 891

$\sum fx = 2338$

$\sum fx^2 = 2614$

$\sum f | d | = 12564.23$



Measures of Central Tendency, Variability and Divergence from Normality.

The methods of calculating these measures were the same as followed in the previous case.

Mean	=	<u>47.17</u>
Median	=	<u>47.84</u>
Mode	=	<u>48.58</u>
Quartile Deviation.	=	<u>12.94</u>
Mean Deviation	=	<u>14.10</u>
Standard Deviation	=	<u>16.91</u>
Skewness in Terms of Percentiles	=	<u>-1.42</u>
Kurtosis	=	<u>0.285</u>

Reliability of the above five measures Mean, Median, Skewness, Kurtosis and Standard Deviation.

Mean:-

$$O_M = \frac{O}{\sqrt{N}} = \frac{16.91}{\sqrt{891}} = 0.5665$$

Therefore the limits of accuracy with in which the True Mean falls are  $47.17 \pm 1.96 \times .5665$ , i.e.  $47.17 \pm 1.11$  i.e. 46.06 and 48.28 at the .05 confidence level and  $47.17 \pm 2.58 \times .5665$  i.e.  $47.17 \pm 1.46$  or 45.71 and 48.63 at .01 confidence level of significance.



Median:-

$$\begin{aligned}
 J_{\text{Med}} &= \frac{1.253 \sigma}{\sqrt{N}} \\
 &= \frac{1.253 \times 16.91}{\sqrt{891}} \\
 &= 0.7098
 \end{aligned}$$

Therefore the limits of accuracy for the True Median are  $17.64 \pm 1.96 \times .7098$  or  $17.64 \pm 1.39$  or  $16.25$  or  $19.03$  at  $.05$  confidence level and  $17.64 \pm 2.58 \times .7098$  at  $.01$  confidence level.

Standard Deviation:-

$$\begin{aligned}
 J_{\text{SD}} &= \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 16.91}{\sqrt{891}} \\
 &= 0.4023
 \end{aligned}$$

Therefore the True S.D. lies between  $16.91 \pm 1.96 \times .4023$  i.e.  $16.91 \pm 0.79$  or  $16.12$  and  $17.70$  at  $.05$  level of significance and between  $16.91 \pm 2.58 \times .4023$  or  $16.91 \pm 0.0161$  is  $16.39$  and  $18.93$  at the  $.01$  level of significance.

Skewness:-

Obtained Skewness = -1.42

$$\begin{aligned}
 J_{\text{SK}} &= \frac{0.5185 D}{\sqrt{N}} \quad \text{Where } D = P_{90} - P_{10} = 45.42 \\
 &= \frac{0.5185 \times 45.42}{\sqrt{891}} = 0.7884
 \end{aligned}$$

Therefore G.S. =  $\frac{-1.42}{.7884} = -1.12$  which is well with in





the 1.96 level of confidence and much below the 2.58 level of significance. Hence the obtained Skewness of - 1.42 is not significant and the distribution does not deviate from the normal to any great extent.

Kurtosis:-

Obtained Ku = 0.285

Therefore the deviation from the normal

= 0.285 - 0.263 = 0.022, the positive sign indicating a tendency to be platy kurtic.

$$\sigma_{Ku} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{891}} = 0.00938$$

$$\text{Therefore J.K.} = \frac{0.022}{.00938} = 2.345 = 2.34$$

which is greater than 1.96 but less than 2.58. Hence the Kurtosis is significant at the .05 level but not at the .01 level of confidence.

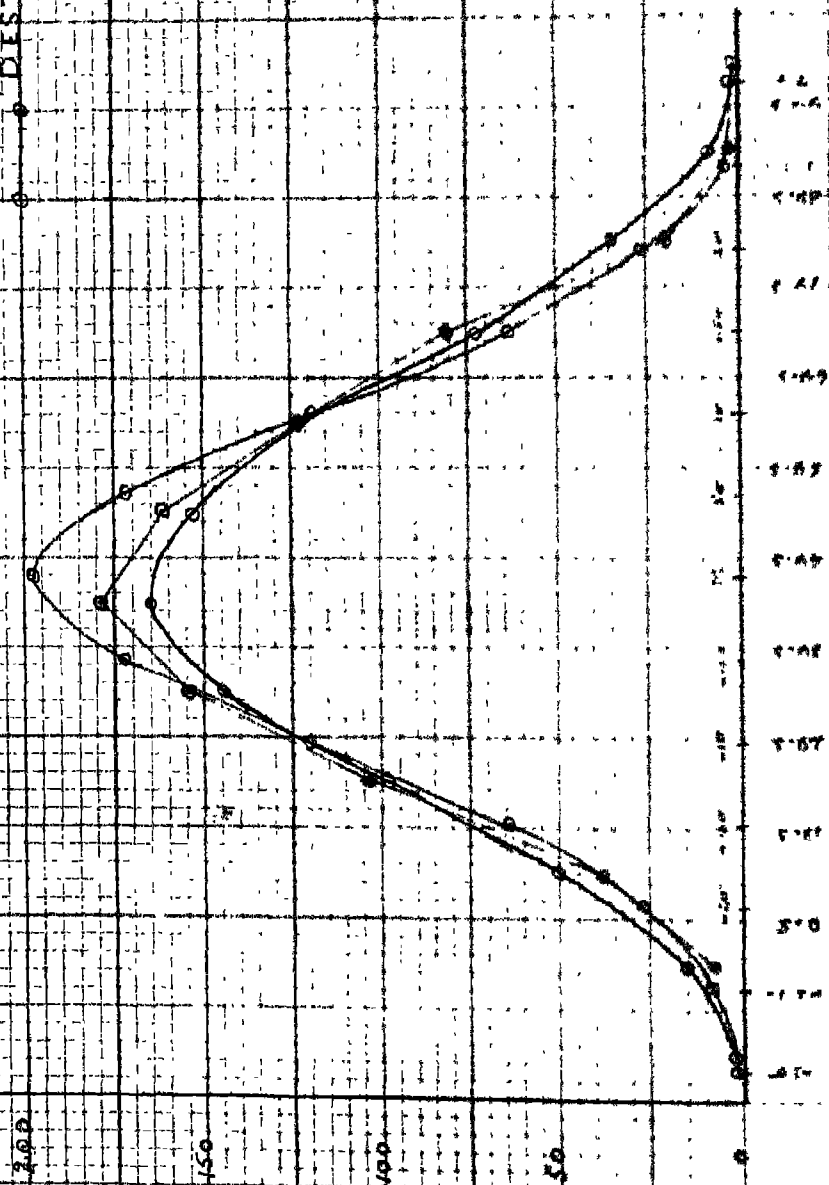




FREQUENCY POLYGON

SMOOTHED FRECY POLYN

BEST FITTING N.P.C



# Frequency Distribution - Urban

c.i	M.P.	f	x	fx	fx <sup>2</sup>	$\sum (x-M) = \sum d$	$\sum f d$	c.f	c.f c	s.f.	s.f.c
1	2	3	4	5	6	7	8	9	10	11	12
90-99	94.5	2	5	10	50	47.33	94.66	866	100.0	7.3	99.9
80-89	84.5	20	4	80	320	37.33	746.60	864	99.8	34.3	99.1
70-79	74.5	81	3	243	729	27.33	2213.73	844	97.5	73.7	95.1
60-69	64.5	120	2	240	480	17.33	2079.60	763	88.1	121.0	86.6
50-59	54.5	162	1	162	162	7.33	1187.46	643	74.2	153.7	72.6
40-49	44.5	179	0	...	0	2.67	477.93	481	55.5	165.0	54.9
30-39	34.5	154	-1	-154	154	12.67	1951.18	308	34.9	145.3	35.8
20-29	24.5	103	-2	-206	412	22.67	2335.01	148	17.1	97.7	19.1
10-19	14.5	36	-3	-108	324	32.67	1176.12	45	5.2	49.3	7.8
0-9	4.5	9	-4	-36	144	42.67	384.03	9	1.0	15.0	2.1
		0						0	0.0	3.0	0.3

N = 866

$\sum fx = 231$

$\sum fx^2 = 2775$

$\sum f d = 12646.32$

0.7 1.0



Measures of Central Tendency, Variability and Divergence from Normality.

Mean	=	<u>47.17</u>
Median	=	<u>46.82</u>
Mode	=	<u>46.12</u>
Quartile Deviation	=	<u>13.09</u>
Mean Deviation	=	<u>14.6</u>
Standard Deviation	=	<u>17.49</u>
Skewness in Terms of Percentiles	=	<u>0.71</u>
Kurtosis	=	<u>0.273</u>

Reliability of the Mean, Median, Standard Deviation, Skewness and Kurtosis.

Mean:-

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{17.49}{\sqrt{866}} = 0.594$$

Therefore the obtained Mean being 47.17, the True Mean lies between  $47.17 \pm 1.96 \times 0.594$  i.e. 46.00 and 48.34 at .05 level and between  $47.17 \pm 2.58 \times .594$  i.e. 45.64 and 48.80 at the .01 level of confidence.

Median:-

$$\sigma_{Min} = \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 17.49}{\sqrt{866}} = 0.9404.$$

Therefore the limits of accuracy for the True Median at 0.05 level of significance are  $46.82 \pm 1.96 \times .9404$  i.e. 45.36 and 48.28 and at .01 level of significance





are  $46.82 \pm 2.58 \times 0.9404$  i.e. 44.9 and 48.74

Standard Deviation:-

$$\sigma_{\sigma} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 17.49}{\sqrt{866}} = 0.4219$$

Therefore the True SD lies between  $17.49 \pm 1.96 \times .4219$  i.e. 16.66 and 18.32 at the .05 level of confidence and between  $17.49 \pm 2.58 \times .4219$  or 16.4 and 18.58 at the .01 level of significance.

Percentile Skewness:-

$$\begin{aligned} \overline{OSK} &= \frac{0.5185 D}{\sqrt{N}} = \frac{.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 47.98}{\sqrt{866}} \\ &= 0.967 \end{aligned}$$

The obtained skewness  $SK = 0.71$ . Hence  $Z.R =$

$\frac{0.71}{0.967} = 0.84$  which is far below 1.96 and still

farther below 2.58 at the .05 and .01 levels of significance. Hence the skewness is negligible and the distribution is almost normal.

Kurtosis:-

$$\overline{OKu} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{866}} = 0.009515$$

The deviation from the normal  $= 0.273 - 0.263$   
 $= 0.01$ .

$$\text{Therefore } C.R = \frac{0.01}{.0095} = 1.05.$$



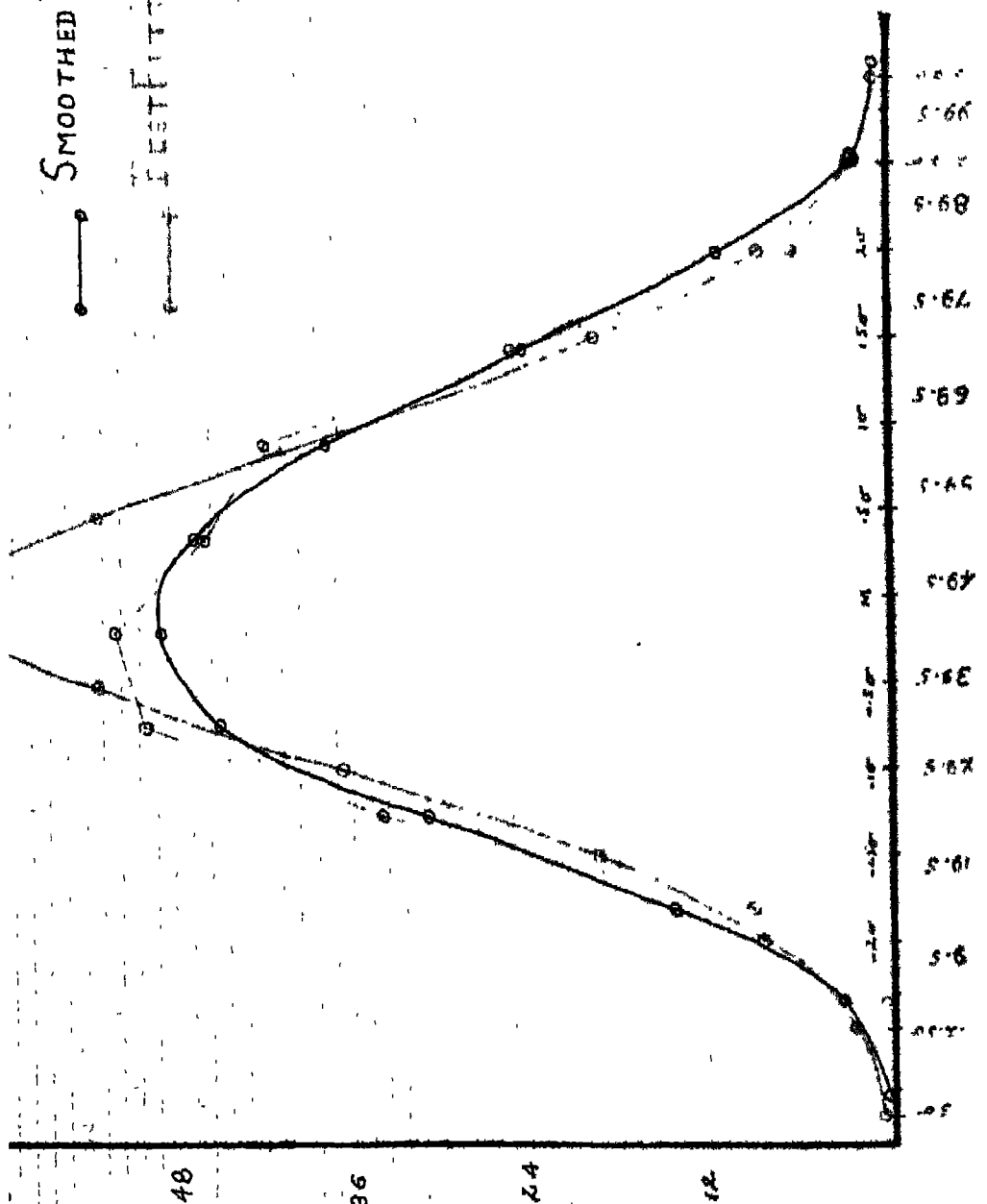
This being well within 1.96 and far below 2.58  
the distribution is no more flat than the normal.

SMOOTHED FRECY, POLYGON

TEST FITTING N.P.E.

—●—

—○—



# Frequency Distribution - Industrial

c.i	M.P.	f	x	fx	fx <sup>2</sup>	$\sum (x-M)^2$	f i d	c.f	o.f	s.f.	s.o.f
1	2	3	4	5	6	7	8	9	10	11	12
80-99	94.5	2	5	10	50	46.47	92.94	266	100.0	0.6	100.0
80-89	84.5	6	4	24	96	36.47	218.82	264	99.2	11.0	98.7
70-79	74.5	25	3	75	225	26.47	661.75	258	97.0	24.1	94.6
60-69	64.5	42	2	84	168	16.47	691.74	233	87.6	37.7	86.5
50-59	54.5	46	1	46	46	6.47	297.62	191	71.8	46.7	71.3
40-49	44.5	58	0	..	0	3.53	183.56	145	54.5	48.1	53.8
30-39	34.5	50	-1	-60	50	13.53	676.50	93	35.0	45.1	35.2
20-29	24.5	34	-2	-68	136	23.53	800.02	43	16.2	31.0	18.2
10-19	14.5	9	-3	-27	81	33.53	301.77	9	3.4	14.3	6.5
0-9	4.5	0	-4	0	0	43.53	0	0	0	3.0	1.1
								0	0	0.0	0.0

N=266

$\sum fx = 94$

$\sum fx^2 = 852$

$\sum f i d i = 3924.72$



Measures of Central Tendency, Variability and Divergence from Normality.

Mean	=	<u>48.03</u>
Median	=	<u>47.19</u>
Mode	=	<u>45.51</u>
Quartile Deviation	=	<u>13.66</u>
Mean Deviation	=	<u>14.75</u>
Standard Deviation	=	<u>17.55</u>
Skewness in Terms of Percentiles	=	<u>1.18</u>
Kurtosis	=	<u>0.288</u>

Reliability of Mean, Median, Standard Deviation, Skewness and Kurtosis.

Mean:-

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{17.55}{\sqrt{266}} = 1.076$$

Therefore at the 0.05 level of significance the True Mean lies between  $48.03 \pm 1.96 \times 1.076$  i.e. 45.92 and 50.14. And at the 0.01 level between  $48.03 \pm 2.58 \times 1.076$  i.e. 45.25 and 50.81

Median:-

$$\begin{aligned} \sigma_{Mdn} &= \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 17.55}{\sqrt{266}} \\ &= 1.348. \end{aligned}$$

Therefore True Median lies between  $47.19 \pm 1.96 \times 1.348$





i.e. 44.55 and 49.83 at 0.05 level and between  $47.19 \pm 2.58 \times 1.348$  i.e. 43.71 and 50.67 at 0.01 level of significance.

Standard Deviation:-

$$\sigma_s = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 17.55}{\sqrt{266}} = 0.7638$$

Therefore the limits of accuracy for the True SD are  $17.55 \pm 1.96 \times .7638$  i.e. 16.05 and 19.05 at 0.05 level and between  $17.55 \pm 2.58 \times .7638$  i.e. 15.68 and 19.52 at 0.01 level of significance.

Skewness:-

$$\begin{aligned} \sigma_{SK} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 47.38}{\sqrt{266}} = 1.506 \end{aligned}$$

The obtained skewness is 1.18

Therefore C.R =  $\frac{1.18}{1.506} = 0.9513$  which is far below

1.96 or 2.58, the 0.05 and 0.01 levels of significance  
Hence the skewness is negligible and the distribution is almost normal.



Kurtosis:-

$$\sigma_{ku} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{266}} = 0.0171$$

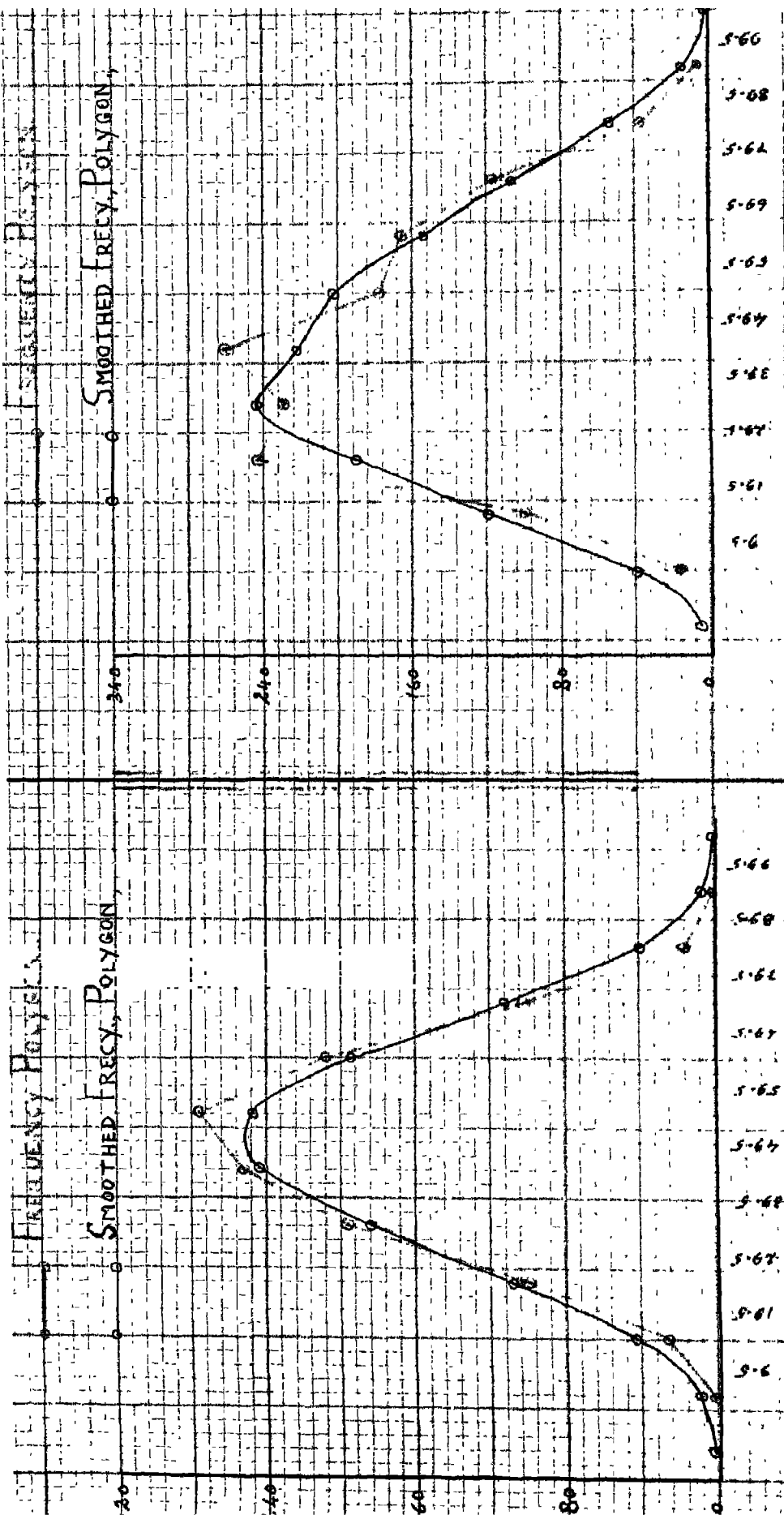
The obtained deviation from the normal =  $0.288 - .263 = 0.025$ .

$$\text{Therefore C.R} = \frac{0.025}{0.0171} = 1.46 \text{ which is well}$$

within 1.96 and 2.58 at the 0.05 and 0.01 levels of confidence. Hence the platykurtosis of the distribution is not of any significance. The distribution is almost mesokurtic.







# Frequency Distribution - Kannada Medium

c.i	M.P.	f	x	fx	fx <sup>2</sup>	$\sum (x-M)^2$	f i d i	c.f	c/f	s.f.	s.c.f
1	2	3	4	5	6	7	8	9	10	11	12
		0						1.178	100.0	0.0	100.00
90-99	94.5	0	4	0	0	15.03	0	1.178	100.0	5.3	100.00
80-89	84.5	16	3	48	144	35.03	560.48	1.178	100.0	39.3	99.83
70-79	74.5	102	2	204	408	25.03	2563.06	1.162	98.6	108.7	96.50
60-69	64.5	208	1	208	208	15.03	3126.24	1.060	90.0	195.3	86.96
50-59	54.5	276	0	...	0	5.03	1388.28	858	72.3	245.7	70.40
40-49	44.5	253	-1	-253	253	4.97	1257.41	576	48.9	242.0	49.83
30-39	34.5	197	-2	-394	788	14.97	2949.09	323	27.4	183.3	29.09
20-29	24.5	100	-3	-300	900	24.97	2497.00	126	10.7	107.3	13.45
10-19	14.5	25	-4	-100	400	34.97	874.25	26	2.2	42.0	4.26
0-9	4.5	1	-5	-5	25	44.97	44.97	1	0.1	8.7	0.77
		0						0	0.0	0.3	0.03

$\sum f = 1178$

$\sum fx = -592$

$\sum fx^2 = 3186$

$\sum f i d i = 15250.78$





Measures of Central Tendency, Variability and Divergence from Normality:

Mean	=	<u>49.47</u>
Median	=	<u>49.97</u>
Mode	=	<u>50.97</u>
Quartile Deviation	=	<u>11.48</u>
Mean Deviation	=	<u>12.95</u>
Standard Deviation	=	<u>15.50</u>
Skewness in Terms of Percentiles	=	<u>-0.885</u>
Kurtosis	=	<u>0.281</u>

Reliability of Mean, Median, Standard Deviation, and Skewness and Kurtosis:

Mean:-

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{15.50}{\sqrt{1178}} = 0.4516$$

Limits of accuracy of the True Mean =  $49.47 \pm 1.96 \times .4516$  i.e. 48.58 and 50.36 at 0.05 level and  $49.47 \pm 2.58 \times .4516$  i.e. 48.30 and 50.64 at 0.01 level of confidence.

Median:-

$$\sigma_{Mdn} = \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 15.50}{\sqrt{1178}} = 0.5657$$

Hence True Median lies between  $49.97 \pm 1.96 \times .5657$



that is 48.86 and 51.08 at 0.05 level and between 49.97  $\pm$  2.58  $\times$  .5657 or 48.51 and 51.43 at 0.01 level of confidence.

Standard Deviation:-

$$\sigma = \frac{0.710}{\sqrt{N}} = \frac{0.71 \times 15.5}{\sqrt{1178}} = 0.3206$$

Hence the population SD lies between 15.5  $\pm$  1.96  $\times$  .3206 i.e. 14.87 and 16.13 at 0.05 level and between 15.5  $\pm$  2.58  $\times$  .3206 or 14.67 and 16.33 at 0.01 level of significance.

Skewness:-

$$\begin{aligned} g_{sk} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 40.87}{\sqrt{1178}} = 0.6175 \end{aligned}$$

Therefore C.R =  $\frac{-0.885}{0.6175} = -1.43$ . This value is well

within 1.96 at 0.05 level and 2.58 at 0.01 level of confidence. Hence the obtained skewness of -0.885 does not indicate any significant divergence from the normal.



Kurtosis:-

$$\begin{aligned} \sigma_{Ku} &= \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{1178}} \\ &= 0.009598 \end{aligned}$$

$$\begin{aligned} \text{Therefore } J.R &= \frac{0.281 - .263}{0.009598} = \frac{0.018}{0.009598} \\ &= 2.21 \end{aligned}$$

2.21 is greater than 1.96 but less than 2.58.

Hence the platy kurtosis is significant at the ~~0.05~~ 0.05 level but insignificant at the 0.01 level.



# Frequency Distribution - English Medium

c.i	M.P.	f	x	fx	fx <sup>2</sup>	$\frac{f \cdot x - M}{d}$	f	f d	c.f	c.f	s.f.	$\frac{c.f}{N}$
1	2	3	4	5	6	7	8	9	10	11	12	
90-99	94.5	4	5	30	100	50.27	201.08	845	100.0	1.3	100.00	
80-89	84.5	23	4	92	368	40.27	926.21	841	99.5	33.3	98.77	
70-79	74.5	73	3	219	657	30.27	2209.71	815	96.8	66.7	94.53	
60-69	64.5	104	2	208	416	20.27	2108.08	745	88.2	96.0	88.87	
50-59	54.5	111	1	111	111	10.27	1139.97	641	75.9	126.0	75.80	
40-49	44.5	163	0	...	0	0.27	44.01	530	62.7	139.0	60.87	
30-39	34.5	143	-1	-143	143	9.73	1391.39	367	43.4	152.7	44.20	
20-29	24.5	152	-2	-304	608	19.73	2998.96	224	28.5	119.0	26.17	
10-19	14.5	62	-3	-186	558	29.73	1843.26	72	8.6	74.7	12.10	
0-9	4.5	10	-4	-40	160	39.73	397.30	10	1.2	24.0	3.87	
	4.5	0						0	0.0	3.3	0.40	

N=845

$$\sum fx = -23$$

$$\sum fx^2 = 3121$$

$$\sum f d = 13269.97$$





Measures of Central Tendency, Variability and Divergence from Normality.

Mean	=	<u>44.23</u>
Median	=	<u>42.9</u>
Mode	=	<u>40.24</u>
Quartile Deviation	=	<u>15.09</u>
Mean Deviation	=	<u>15.69</u>
Standard Deviation	=	<u>19.2</u>
Skewness in Terms of Percentiles	=	<u>3.07</u>
Kurtosis	=	<u>0.294</u>

Reliability of Mean, Median, Standard Deviation, Skewness and Kurtosis.

Reliability of Mean:-

$$O_M = \frac{\sigma}{\sqrt{N}} = \frac{19.2}{\sqrt{845}} = 0.6604$$

True Mean lies between  $44.23 \pm 1.96 \times .6604$  that is 42.94 and 45.52 at 0.05 level of confidence and between  $44.23 \pm 2.58 \times .6604$  i.e. 42.53 and 45.93 at the 0.01 level of confidence.

Reliability of Median:-

$$\sigma_{Mdn} = \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 19.2}{\sqrt{845}} = 0.8273$$

Hence the limits of accuracy for the True Median are  $42.9 \pm 1.96 \times .8273$  or 41.28 and 44.52 at the 0.05 level of confidence and  $42.9 \pm 2.58 \times 0.8273$  or 40.77 and 45.03 at the 0.01 level of confidence.



Reliability of S.D.

$$\sigma_{\sigma} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 19.2}{\sqrt{845}} = 0.4689$$

Hence the population SD lies between  $19.2 \pm 1.96 \times 0.4689$   
 or 18.28 and 20.12 at 0.05 level  
 and -do-  $19.2 \pm 2.58 \times 0.4689$  at 0.01 level

Reliability of Skewness:

$$\begin{aligned} \sigma_{sk} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{845}} \\ &= \frac{0.5185 \times 51.3}{\sqrt{845}} \\ &= 0.9828 \end{aligned}$$

$$\text{Therefore C.R} = \frac{3.07}{0.9828} = 3.36$$

3.36 is outside 1.96 and 2.58 at the 0.05 and 0.01 levels of confidence. Hence the distribution shows a significance divergence from the normal and is positively skewed with the scores passing at the low end of the scale.

Reliability of Kurtosis:-

$$\sigma_{ku} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{845}} = 0.009632$$

$$\text{Therefore C.R} = \frac{0.294 - 0.263}{0.009632} = 3.219$$

3.219 is greater than 1.96 at 0.05 level of confidence and -do- 2.58 at 0.01 do  
 Hence the platy Kurtosis of the distribution is significant. This is explained by the wide distribution of scores in the middle range. (  $q = 15.09$  )





FREQUENCY POLYGON

SMOOTHED REC. POLYGON

320

240

160

80

0

28.5

29.5

30.5

31.5

32.5

33.5

34.5

35.5

36.5

37.5

38.5

39.5

40.5

41.5

42.5

43.5

44.5

45.5

46.5

47.5

48.5

28.5

29.5

30.5

31.5

32.5

33.5

34.5

35.5

36.5

37.5

38.5

39.5

40.5

41.5

42.5

43.5

44.5

45.5

46.5

47.5

48.5

28.5

29.5

30.5

31.5

32.5

33.5

34.5

35.5

36.5

37.5

38.5

39.5

40.5

41.5

42.5

43.5

44.5

45.5

46.5

47.5

48.5

28.5

29.5

30.5

31.5

32.5

33.5

34.5

35.5

36.5

37.5

38.5

39.5

40.5

41.5

42.5

43.5

44.5

45.5

46.5

47.5

48.5

28.5

29.5

30.5

31.5

32.5

33.5

34.5

35.5

36.5

37.5

38.5

39.5

40.5

41.5

42.5

43.5

44.5

45.5

46.5

47.5

48.5

28.5

29.5

30.5

31.5

32.5

33.5

34.5

35.5

36.5

37.5

38.5

39.5

40.5

41.5

42.5

43.5

44.5

45.5

46.5

47.5

48.5

# Frequency Distribution - Boys

C.I	M.P.	f	x	fx	$fx^2$	$\sum (x-M)^2$	$f \mid d \mid$	C.F	cf f	S.F	$\frac{f \times 100}{N}$
1	2	3	4	5	6	7	8	9	10	11	12
90-99	94.5	4	4	16	64	45.82	183.28	1501	100.0	1.3	100.0
80-89	84.5	35	3	105	315	35.82	1253.70	1497	99.7	62.0	99.0
70-79	74.5	147	2	294	588	25.82	3795.54	1462	97.4	148.7	94.0
60-69	64.5	264	1	264	264	15.82	4176.48	1315	87.6	235.3	85.0
50-59	54.5	295	0	...	0	5.82	1716.90	1051	70.0	282.3	69.3
40-49	44.5	288	-1	-288	288	4.18	1203.84	756	50.4	269.0	50.5
30-39	34.5	224	-2	-448	896	14.18	3176.32	468	31.1	226.3	32.0
20-29	24.5	167	-3	-501	1503	24.18	4038.06	244	16.3	153.7	17.5
10-19	14.5	70	-4	-280	1120	34.18	2392.60	77	5.1	81.3	7.3
0-9	4.5	7	-5	-35	175	44.18	309.26	7	0.5	25.3	1.9
		0						0	0.0	2.3	0.17

N = 1501

$\sum fx =$   
-873

$\sum fx^2 =$   
5213

$\sum (f \mid d \mid) =$   
22245.98





Measures of Central Tendency, Variability and Divergence from Normality:

Mean	=	<u>48.68</u>
Median	=	<u>49.31</u>
Mode	=	<u>50.57</u>
Quartile Deviation	=	<u>13.48</u>
Mean Deviation	=	<u>14.82</u>
Standard Deviation	=	<u>17.71</u>
Skewness in Terms of Percentile	=	<u>-1.4</u>
Kurtosis	=	<u>0.281</u>

Reliability of Mean, Median, Standard Deviation, Skewness and Kurtosis:-

Reliability of Mean:

$$\sigma_{\bar{N}} = \frac{\sigma}{\sqrt{N}} = \frac{17.71}{\sqrt{1501}} = 0.4571$$

Therefore the True Mean <sup>lies between</sup>  $48.68 \pm 1.96 \times 0.4571$  or 47.78 & 49.58  
at 0.05 level

and - do-  $48.68 \pm 2.58 \times 0.4571$  or 47.50 & 49.86  
at 0.01 level

Reliability of Median:-

$$\sigma_{\bar{M}} = \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 17.71}{\sqrt{1501}} = 0.5727$$

Therefore the T.M. lies between  $49.31 \pm 1.96 \times 0.5727$   
or 48.19 and 50.43  
at 0.05 level

and - do -  $49.31 \pm 2.58 \times 0.5727$   
or 47.83 & 50.79  
at 0.01 level



Reliability of SD:

$$\frac{\sigma}{\sigma} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 17.71}{\sqrt{1501}} = 0.3245$$

Therefore the T. SD lies between  $17.71 \pm 1.96 \times .3245$   
or  $17.07$  &  $18.35$   
at  $0.05$  level

and -do -  $17.71 \pm 2.58 \times .3245$   
or  $16.87$  &  $18.55$   
at  $0.01$  level

Reliability of Skewness:

$$\begin{aligned} \sigma_{SK} &= \frac{.5185 D}{\sqrt{N}} = \frac{.5185 (P_{90} - P_{10})}{\sqrt{1501}} \\ &= \frac{.5185 \times 48.06}{\sqrt{1501}} = 0.6430 \end{aligned}$$

$$C.R = \frac{-1.4}{0.6430} = -2.18$$

- 2.18 is greater than 1.96 at 0.05 level

do less than 2.58 at 0.01 level

Hence the divergence is significant at the .05 level but not so at the .01 level of confidence.

Reliability of Kurtosis:

$$\sigma_{Ku} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{1501}} = .0072$$

$$C.R = \frac{(0.281 - 0.263)}{.0072} = \frac{0.018}{.0072} = 2.49$$

2.49 is greater than 1.96 but less than 2.58. Hence the platy kurtosis is significant at 0.05 level but insignificant at 0.01 level of confidence.



# Frequency Distribution - Girls

c.i	M.P.	f	x	fx	fx <sup>2</sup>	X-M	f  d	c.f	%f	s.f	s.e.f
1	2	3	4	5	6	7	8	9	10	11	12
		0						522	100.0	0.0	100.0
90-99	94.5	0	5	0	0	51.25	0.00	522	100.0	1.3	100.0
80-89	84.5	4	4	16	64	41.25	166.00	522	100.0	10.7	99.7
70-79	74.5	28	3	84	252	31.25	875.00	518	99.2	26.7	97.7
60-69	64.5	48	2	96	192	21.25	1020.00	490	93.9	56.0	92.6
50-59	54.5	92	1	92	92	11.25	1035.00	442	84.7	89.3	81.5
40-49	44.5	128	0	..	..	1.25	160.00	350	65.8	112.0	64.3
30-39	34.5	116	-1	-116	116	8.75	1015.00	222	42.5	109.7	42.9
20-29	24.5	86	-2	-170	340	18.75	1593.75	106	20.3	72.7	22.3
10-19	14.5	17	-3	-51	153	28.75	201.25	21	4.0	35.3	8.4
0-9	4.5	4	-4	-16	64	38.75	155.00	4	0.8	7.0	1.6
		0						0	0.0	1.3	0.3

$\Sigma fx = -65$   
 $\Sigma fx^2 = 1273$   
 $\Sigma f |d| = 6220.00$

N = 522



Measures of Central Tendency, Variability and Divergency  
from Normality.

Mean	=	<u>43.25</u>
Median	=	<u>42.55</u>
Mode	=	<u>41.15</u>
Quartile Deviation	=	<u>11.2</u>
Mean Deviation	=	<u>11.92</u>
Standard Deviation	=	<u>15.56</u>
Skewness in Terms of Percentiles	=	<u>1.68</u>
Kurtosis	=	<u>0.266</u>

Reliability of Mean, Median, Standard Deviation, Skewness  
and Kurtosis:

Reliability of Mean:

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{15.56}{\sqrt{522}} = 0.6870$$

the T.M. lies between  $43.25 \pm 1.96 \times .6870$  or 41.91 & 44.59  
 at 0.05 level

and do  $43.25 \pm 2.58 \times .6870$  or 41.49 & 45.01  
 at 0.01 level

Reliability of Median:-

$$\sigma_{Min} = \frac{1.253\sigma}{\sqrt{N}} = \frac{1.253 \times 15.56}{\sqrt{522}} = 0.8531$$

T.Min lies between  $42.55 \pm 1.96 \times 0.8531$  or 40.88 & 44.22  
 at 0.05 level

and do  $42.55 \pm 2.58 \times .8531$  or 40.35 & 44.75  
 at 0.01 level





Reliability of SD:

$$O_{SD} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 15.56}{\sqrt{522}} = 0.4835$$

T.SD lies between  $15.56 \pm 1.96 \times .4835$  or 14.61 & 16.51  
at 0.05 level

and -do  $15.56 \pm 2.58 \times 0.4835$  or 14.31 & 16.81  
at 0.01 level

Reliability of Skewness:

$$O_{ST} = \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}}$$

$$= \frac{0.5185 \times 42.13}{\sqrt{522}} = 0.9559$$

$$T.R = \frac{1.68}{0.9559} = 1.76$$

1.76 is less than 1.96 at 0.05 level

do 2.58 at 0.01 level

Hence the Skewness of 1.68 is not significant at both the levels of confidence.

Reliability of Kurtosis:

$$O_{Ka} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{522}} = 0.0122$$

$$C.R = \frac{(0.266 - 0.263)}{0.0122} = \frac{0.003}{0.0122}$$

$$= 0.245$$

0.245 is far below 1.96 and 2.58 at both the levels of confidence. Hence the distribution has no divergence from the normal.

U R B A N : N = 210

2. R U R A L : N = 727

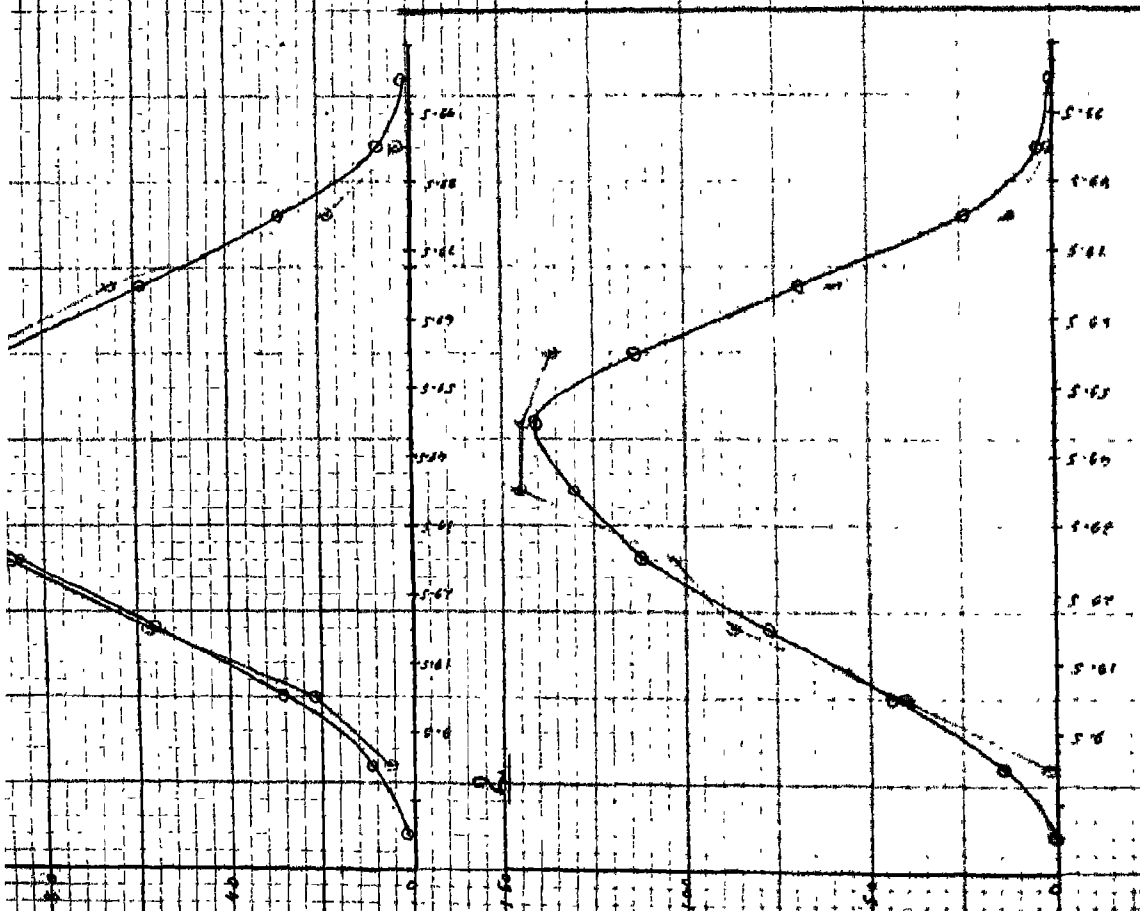
3. I N D U S T R I A L : N = 196

F R E Q U E N C Y P O L Y G O N

S M O O T H E D F R E Q . P O L Y G O N

○ — — — ○

3



# Frequency Distribution - Boys - Rural.

c.i	M.P	f	x	fx	$fx^2$	$\sum x-M$ =d	fM <sup>2</sup>	c.f	c.f f	Smoothed f	Sm. e. f
1	2	3	4	5	6	7	8	9	10	11	12
		0						727	100.00	0.0	100.0
90-99	94.5	0	5	0	0	46.74	0.00	727	100.0	4.0	100.0
80-89	84.5	12	4	48	192	36.74	440.88	727	100.0	23.6	99.4
70-79	74.5	59	3	177	531	26.74	1577.66	715 715	98.3	69.0	96.8
60-69	64.5	136	2	272	544	16.74	2276.64	666	90.2	113.0	86.7
50-59	54.5	144	1	144	144	6.74	970.56	520	71.5	141.6	71.1
40-49	44.5	145	0	..	0	3.26	472.70	376	51.7	130.3	51.7
30-39	34.5	102	-1	-102	102	13.26	1362.62	231	31.8	111.3	33.7
20-29	24.5	87	-2	-174	348	23.26	2083.62	129	17.7	76.3	18.4
10-19	14.5	40	-3	-120	360	33.26	1330.40	42	5.8	43.0	7.9
0-9	4.5	2	-4	-8	32	13.26	86.52	2	0.3	14.0	2.0
		0						0	0.0	0.7	0.1

$\sum f = 727$        $\sum fx = 237$        $\sum fx^2 = 2253$        $\sum fM^2 = 10531.50$



Measures of Central Tendency, Variability and Divergence  
from Normality:

Mean	=	<u>47.76</u>
Median	=	<u>48.64</u>
Mode	=	<u>50.40</u>
Quartile Deviation	=	<u>13.34</u>
Mean Deviation	=	<u>14.49</u>
Standard Deviation	=	<u>17.86</u>
Skewness in Terms of Percentiles	=	<u>-2.73</u>
Kurtosis	=	<u>0.284</u>

Reliability of Mean, Median, Standard Deviation, Skewness  
and Kurtosis:

Reliability of Mean:

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{17.86}{\sqrt{727}} = .6625$$

the T.M. lies between  $47.76 \pm 1.96 \times .6625$  or 46.46 & 49.05  
at 0.05 level

and -do-  $47.76 \pm 2.58 \times .6625$  or 46.05 & 49.47  
at 0.01 level

Reliability of Median:-

$$\sigma_{Mdn} = \frac{1.253}{\sqrt{N}} = \frac{1.253 \times 17.86}{\sqrt{727}} = 0.8301$$

T.Mdn lies between  $48.64 \pm 1.96 \times 0.8301$  or 47.01 & 50.27  
at 0.05 level

and do  $48.64 \pm 2.58 \times 0.8301$  or 46.50 & 50.78  
at 0.01 level



Reliability of SD:

$$\sigma_{\sigma} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 17.86}{\sqrt{727}} = 0.4704$$

T.SD lies between  $17.86 \pm 1.96 \times 0.4704$  or  $16.94$  &  $18.78$   
at 0.05 level

and -do-  $17.86 \pm 2.58 \times .4704$  or  $16.65$  &  $19.07$   
at 0.01 level

Reliability of Skewness:

$$\begin{aligned} \sigma_{sk} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 46.93}{\sqrt{727}} = 0.9802 \end{aligned}$$

$$G.R = \frac{-2.73}{0.9802} = -3.03$$

- 3.03 is greater than  $\pm 1.96$  at 0.05 level  
do  $2.58$  at 0.01 level

Hence the distribution shows a significant divergence from the normal on the negative side.

Reliability of Kurtosis:

$$\begin{aligned} \sigma_{ku} &= \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{727}} = 0.0103 \\ G.R &= \frac{(0.284 - .263)}{0.01039} = \frac{0.021}{0.01039} = 2.214 \end{aligned}$$

2.214 is greater than  $1.96$  at 0.05 level  
and do less than  $2.58$  at 0.01 level. Hence  
the Kurtosis is significant at 0.05 level but insignificant  
at 0.01 level.





# Frequency Distribution - Boys - Urban

c.i	M.P.	f	x	fx	fx <sup>2</sup>	f(x-M) <sup>2</sup>	f(x-M)	cf	fd	cf-d	c.f	s.f	s.o.f
1	2	3	4	5	6	7	8	9	10	11	12		
90-99	94.5	2	4	8	32	45.0	90	578	100.0	0.7	100.0		
80-89	84.5	17	3	51	153	35.0	595	576	98.7	28.0	98.8		
70-79	74.5	65	2	130	260	25.0	1625	559	96.6	58.7	93.9		
60-69	64.5	91	1	94	94	15.0	1410	494	85.5	91.7	83.8		
50-59	54.5	116	0	0	0	5.0	580	400	69.2	107.3	67.9		
40-49	44.5	112	-1	-112	112	15.0	1680	284	49.1	105.3	49.4		
30-39	34.5	88	-2	-173	352	25.0	2200	172	29.8	86.0	31.1		
20-29	24.5	58	-3	-174	522	35.0	2030	84	14.5	55.6	16.3		
10-19	14.5	21	-4	-84	336	45.0	945	26	4.5	38.0	6.6		
0-9	4.5	5	-5	-25	125	55.0	275	5	0.9	8.7	1.8		
		0							0.0	1.7	0.3		

N=578

$\sum fx = 288$

$\sum fx^2 = 1986$

$\sum f(x-M)^2 = 11430$



Measures of Central Tendency, Variability and Divergence  
from Normality:

Mean	=	<u>49.5</u>
Median	=	<u>49.93</u>
Mode	=	<u>50.79</u>
Quartile Deviation	=	<u>13.34</u>
Mean Deviation	=	<u>19.78</u>
Standard Deviation	=	<u>17.86</u>
Skewness in Terms of Percentiles	=	<u>-0.68</u>
Kurtosis	=	<u>0.275</u>

Reliability of Mean, Median, Standard Deviation, Skewness  
and Kurtosis:

Reliability of Mean:

$$\sigma_M = \frac{S}{\sqrt{N}} = \frac{17.86}{\sqrt{578}} = 0.7429$$

the T.M. lies between  $49.5 \pm 1.96 \times 0.7429$  or  $48.04$  &  $50.96$   
at 0.05 level  
and -do-  $49.5 \pm 2.58 \times 0.7429$  or  $47.58$  &  $51.42$   
at 0.01 level

Reliability of Median:-

$$\sigma_{Mdn} = \frac{1.253 S}{\sqrt{N}} = \frac{1.253 \times 17.86}{\sqrt{578}} = 0.9863$$

T.Mdn lies between  $49.93 \pm 1.96 \times 0.9863$  or  $48.03$  &  $51.83$   
at 0.05 level  
and do  $49.93 \pm 2.58 \times 0.9863$  or  $47.53$  &  $52.33$   
at 0.01 level



Reliability of SD:

$$\sigma_{\sigma} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 17.86}{\sqrt{578}} = 0.5274$$

T.SD lies between  $17.86 \pm 1.96 \times 0.5274$  or 16.83 & 18.89  
at 0.05 level

and -do-  $17.86 \pm 2.58 \times 0.5274$  or 16.60 & 19.22  
at 0.01 level

Reliability of Skewness:

$$\begin{aligned} \sigma_{SK} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 48.55}{\sqrt{578}} = 1.047 \end{aligned}$$

$$J.R = \frac{-.68}{1.047} = 0.91$$

0.91 is less than 1.96 at 0.05 level

and do 2.58 at 0.01 level

Hence the skewness is negligible and the distribution is almost normal.

Reliability of Kurtosis:

$$\sigma_{Ku} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{578}} = 0.0116$$

$$J.R = \frac{(0.275 - 0.263)}{0.0116} = \frac{0.012}{0.0116} = 1.03$$

1.03 is less than 1.96 at 0.05 level

and do less than 2.58 at 0.01 level. Hence the platy kurtosis is negligible at both levels of confidence and the distribution does not deviate from the normal to any significant extent.



# Frequency Distribution - Boys - Industrial

3.1	4.2.	f	x	fx	$fx^2$	$\sum (x-M)^2$	$\sum f(x-M)^2$	$\sum f^2$	$\sum f^3$
1	2	3	4	5	6	7	8	9	10
90-99	94.5	2	4	8	32	44.85	89.70	196	100.0
80-89	84.5	6	3	18	54	34.85	209.10	194	98.3
70-79	74.5	23	2	46	92	24.85	1143.10	158	93.0
60-69	64.5	34	1	34	34	14.85	504.90	155	88.3
50-59	54.5	35	0	0	0	4.85	169.75	131	66.7
40-49	44.5	31	-1	-31	31	5.15	159.65	96	49.6
30-39	34.5	34	-2	-68	136	15.15	515.10	66	32.5
20-29	24.5	22	-3	-66	198	25.15	553.30	31	17.7
10-19	14.5	9	-4	-36	144	35.15	316.35	9	6.8
0-9	4.5	0	-5	0	0	45.15	0.00	0	1.5
		0						0	0.0

187

N = 196

$\sum fx = -95$   
 $\sum fx^2 = 721$

$\sum f^2 = 3660.95$





Measures of Central Tendency, Variability and Divergence  
from Normality:

Mean	=	<u>49.65</u>
Median	=	<u>50.07</u>
Mode	=	<u>50.91</u>
Quartile Deviation	=	<u>14.7</u>
Mean Deviation	=	<u>18.68</u>
Standard Deviation	=	<u>18.62</u>
Skewness in Terms of Percentiles	=	<u>-0.66</u>
Kurtosis	=	<u>0.29</u>

Reliability of Mean, Median, Standard Deviation,

Skewness and Kurtosis:

Reliability of Mean:-

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{18.62}{\sqrt{196}} = 1.323$$

the T.M. lies between  $49.65 \pm 1.96 \times 1.323$  or 47.06 & 52.25  
at 0.05 level

and -do-  $49.65 \pm 2.58 \times 1.323$  or 46.24 & 53.06  
at 0.01 level

Reliability of Median:-

$$\sigma_{Mdn} = \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 18.62}{\sqrt{196}} = 1.658$$

T.Mdn lies between  $50.07 \pm 1.96 \times 1.658$  or 46.72 & 53.32  
at 0.05 level

and do  $50.07 \pm 2.58 \times 1.658$  or 45.79 & 54.35  
at 0.01 level



Reliability of SD:

$$\sigma_{\sigma} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 18.52}{\sqrt{196}} = 0.9393$$

T.SD lies between  $18.52 \pm 1.96 \times 0.9393$  or 16.98 & 20.36  
at 0.05 level

and -do-  $18.52 \pm 2.58 \times 0.9393$  or 15.09 & 20.95  
at 0.01 level

Reliability of Skewness:

$$\begin{aligned} \sigma_{g_1} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 50.27}{\sqrt{196}} = 1.862 \end{aligned}$$

$$C.R = \frac{-.66}{1.862} = 0.3545$$

0.3545 is far below 1.96 at 0.05 level

and do 2.58 at 0.01 level

Hence the skewness is not significant.

Reliability of Kurtosis:

$$\begin{aligned} \sigma_{K_u} &= \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{196}} = .02 \\ C.R &= \frac{(0.28 - .263)}{0.02} = \frac{0.027}{0.02} = 1.35 \end{aligned}$$

1.35 is less than 1.96 at 0.05 level

and do 2.58 at 0.01 level. Hence the

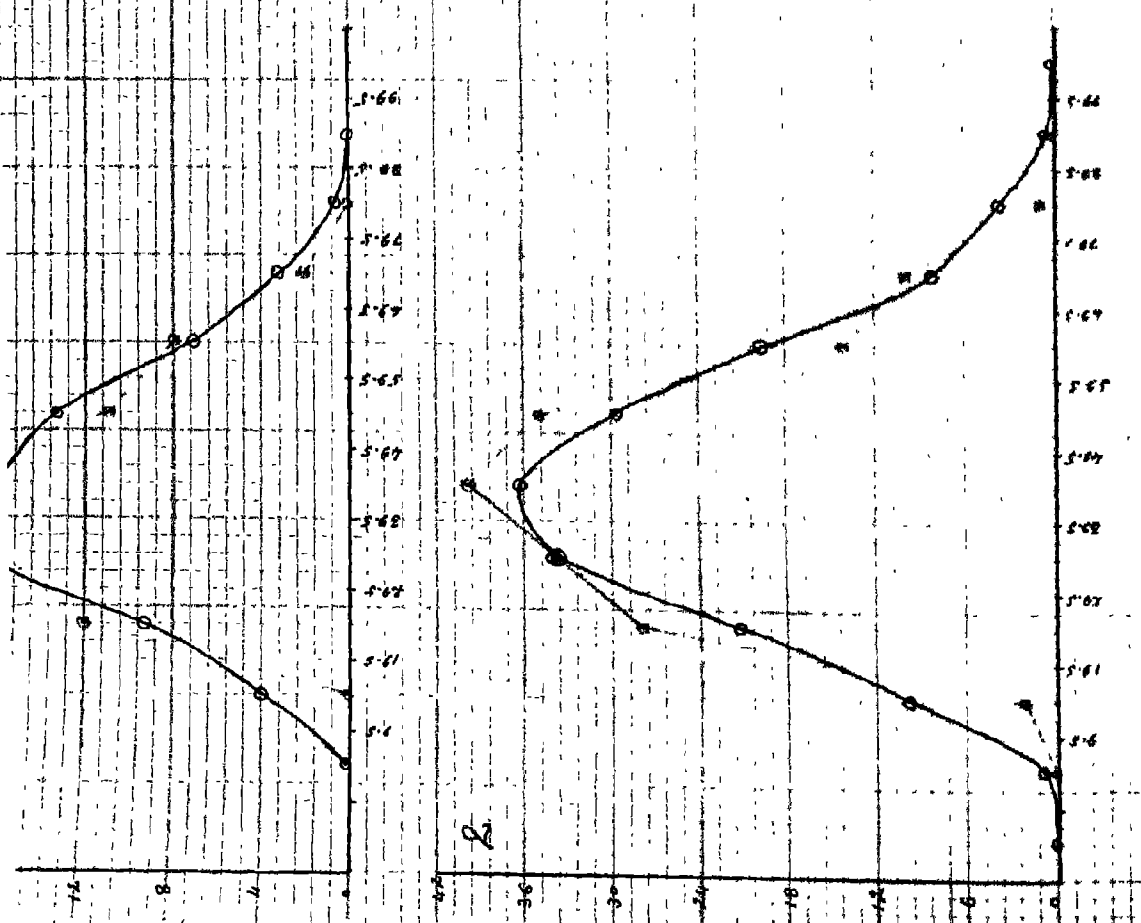
Kurtosis is not significant.

2. R U R A V : 164

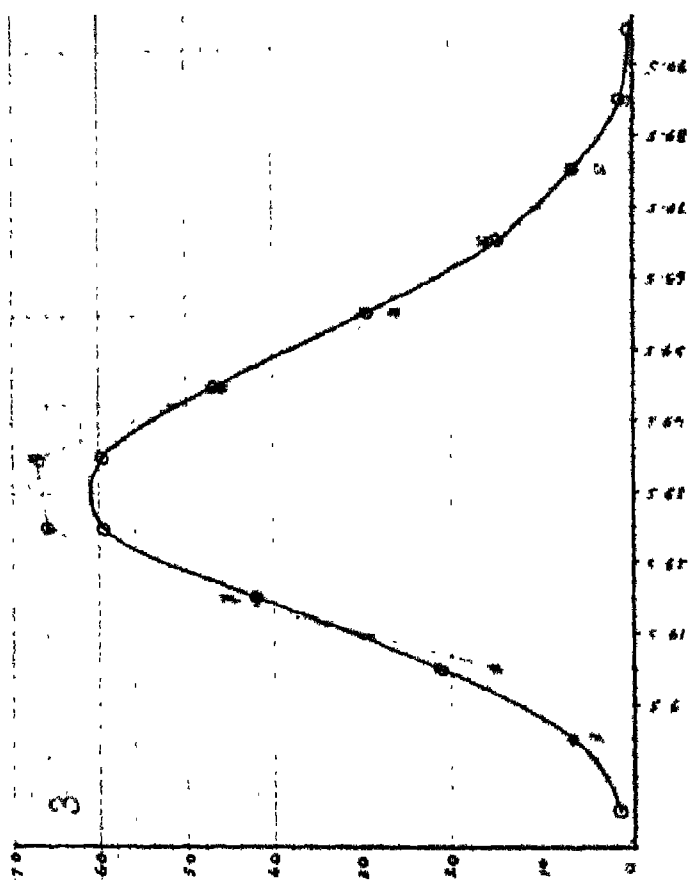
3. U K B A V : 288

ГРЕШУНЦЫ ПОЛYGON.

SMOOTHED ERECY: POLYGON.



3



# Frequency Distribution - Rural Girls

c.i	M.P.	f	x	fx	fx <sup>2</sup>	$\sum x-N = \frac{d}{d}$	f   d	o.f	S.f.
1	2	3	4	5	6	7	8	9	10
90-99	94.5	0	5	0	0	49.94	0.00	164	0.3
80-89	84.5	1	4	4	16	39.94	39.94	164	3.7
70-79	74.5	10	2	30	90	29.94	299.40	161	8.3
60-69	64.5	14	2	28	56	19.94	279.16	153	17.7
50-59	54.5	35	1	35	35	19.94	347.94	139	27.7
40-49	44.5	40	0	0	0	0.06	2.40	104	36.3
30-39	34.5	24	-1	-31	31	10.06	342.04	64	34.0
20-29	24.5	23	-2	-56	112	20.06	561.63	20	21.3
10-19	14.5	2	-3	-6	18	30.06	60.12	2	18.0
0-9	4.5	0	-4	0	0	40.06	0.00	0	0.7
		0							0

N = 164

$\sum x = 1$   $\sum x^2 = 361$

$\sum f | d | =$   
1082.64



Measures of Central Tendency, Variability and Divergence  
from Normality:

Mean	=	<u>44.56</u>
Median	=	<u>44.00</u>
Mode	=	<u>42.88</u>
Quartile Deviation	=	<u>11.09</u>
Mean Deviation	=	<u>11.72</u>
Standard Deviation	=	<u>14.80</u>
Skewness in Terms of Percentiles	=	<u>1.07</u>
Kurtosis	=	<u>0.27</u>

Reliability of Mean, Median, Standard Deviation,

Skewness and Kurtosis:

Reliability of Mean:-

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{14.8}{\sqrt{164}} = 1.16$$

the T.M. lies between  $44.56 \pm 1.96 \times 1.16$  or  $42.29 \& 46.83$   
at 0.05 level

and do  $44.56 \pm 2.58 \times 1.16$  or  $41.58 \& 47.54$   
at 0.01 level

Reliability of Median:-

$$\sigma_{\text{Median}} = \frac{1.253 \sigma}{\sqrt{N}} = \frac{1.253 \times 14.8}{\sqrt{164}} = 1.448$$

T.Min lies between  $44.00 \pm 1.96 \times 1.448$  or  $41.18 \& 46.84$   
at 0.05 level

and do  $44.00 \pm 2.58 \times 1.448$  or  $40.26 \& 47.74$   
at 0.01 level





Reliability of SD:

$$\sigma_o = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 14.8}{\sqrt{164}} = 0.8208$$

T.SD lies between  $14.8 \pm 1.96 \times .8208$  or  $13.19$  &  $16.41$   
at 0.05 level

and do  $14.8 \pm 2.58 \times .8208$  or  $12.68$  &  $16.92$   
at 0.01 level

Reliability of Skewness:-

$$\sigma_{SK} = \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}}$$

$$= \frac{0.5185 \times 41.14}{\sqrt{\frac{1.61}{164}}} = 1.665$$

$$C.R = \frac{1.07}{1.665} = 0.6425$$

0.6425 is less than 1.96 at 0.05 level

and do 2.58 at 0.01 level

Hence the Skewness is insignificant and the distribution does not show any real divergence from the normal.

Reliability of Kurtosis:

$$\sigma_{Ku} = \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{164}} = 0.0218$$

$$C.R = \frac{(0.27 - 0.263)}{0.0218} = \frac{0.007}{0.0218} = 0.3201$$

0.3201 is less than 1.96 at 0.05 level

and do 2.58 at 0.01 level. Hence there is no real divergence from the normal.



# Frequency Distribution - Urban Girls

O.I	U.P.	f	x	fx	fx <sup>2</sup>	Σ (X-M) = 0				c.f	S.L
						1	2	3	4		
1	2	3	4	5	6	7	8	9	10		
30-39	34.5	0	5	0	0	52.05	.00.00	288	1.7		
20-39	34.5	3	4	12	48	42.05	126.15	288	6.3		
70-79	74.5	16	3	48	144	32.05	512.80	288	15.6		
60-69	64.5	26	2	52	104	22.05	572.30	268	29.3		
50-59	54.5	46	1	46	46	12.05	554.30	243	46.3		
40-49	44.5	67	0	0	0	2.05	137.35	197	57.7		
30-39	34.5	66	-1	-66	66	7.95	524.70	130	59.3		
20-29	24.5	45	-2	-90	180	17.95	807.75	64	42.6		
10-19	14.5	15	-3	-45	135	27.95	419.25	19	21.3		
0-9	4.5	4	-4	-16	64	37.95	151.80	4	6.3		
									1.3		

N = 288

Σ fx = -59

Σ fx<sup>2</sup> = 787

Σ f (x - M) = 3807.40



Measures of Central Tendency, Variability and Divergence  
from Normality.

Mean	=	<u>42.45</u>
Median	=	<u>41.6</u>
Mode	=	<u>39.9</u>
Quartile Deviation	=	<u>11.46</u>
Mean Deviation	=	<u>13.22</u>
Standard Deviation	=	<u>16.40</u>
Skewness in Terms of Percentiles	=	<u>2.03</u>
Kurtosis	=	<u>0.26</u>

Reliability of Mean, Median, Standard Deviation, Skewness & Kurtosis.

Reliability of Mean

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{16.40}{\sqrt{288}} = 0.9934$$

the T.M. lies between  $42.45 \pm 1.96 \times 0.9934$  or 40.56 & 44.34  
at 0.05 level

and do  $42.45 \pm 2.58 \times 0.9934$  or 39.96 & 44.94  
at 0.01 level

Reliability of Median:-

$$\sigma_{Mdn} = \frac{1.253\sigma}{\sqrt{N}} = \frac{1.253 \times 16.4}{\sqrt{288}} = 1.211$$

T.Mdn lies between  $41.6 \pm 1.96 \times 1.211$  or 39.23 & 43.97  
at 0.05 level

and do  $41.6 \pm 2.58 \times 1.211$  or 38.48 & 44.72  
at 0.01 level



Reliability of SD:

$$\sigma_{\sigma} = \frac{0.71\sigma}{\sqrt{N}} = \frac{0.71 \times 16.4}{\sqrt{288}} = 0.6861$$

T.SD lies between  $16.4 \pm 1.96 \times 0.6861$  or 15.05 & 17.75  
at 0.05 level

and do  $16.4 \pm 2.58 \times 0.6861$  or 15.15 & 17.65  
at 0.01 level

Reliability of Skewness:-

$$\begin{aligned} \sigma_{SK} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 44.05}{\sqrt{288}} = 1.316 \end{aligned}$$

$$G.R = \frac{2.03}{1.346} = 1.509$$

1.509 is less than 1.96 at 0.05 level

and do 2.58 at 0.01 level.

Hence there is no significant divergence from the normal.

Reliability of Kurtosis:

$$\begin{aligned} \sigma_{Ku} &= \frac{0.28}{\sqrt{N}} = \frac{0.28}{\sqrt{288}} = 0.0165 \\ J.R &= \frac{(0.260 - 0.263)}{0.0165} = \frac{-0.003}{0.0165} = -0.1818 \end{aligned}$$

0.1818 is less than 1.96 at 0.05 level

and do 2.58 at 0.01 level.

Hence the leptokurtosis indicated by  $-0.003$  has no divergence significance and there is no real divergence from the normal.





# Frequency Distribution - Industrial Girls

63										
C.I	M.P.	f	x	fx	$fx^2$	$f(X-M)^2$	f   d   f	o.f	S.f	
1	2	3	4	5	6	7	8	9	10	0
80-89	84.5	0	5	0	0	51	0	0	0	0
80-89	84.5	0	4	0	0	41	0	0	0.7	
70-79	74.5	2	3	6	18	31	68	79	3.3	
60-69	64.5	8	2	16	32	21	168	68	7.0	
50-59	54.5	11	1	11	11	11	121	60	13.3	
40-49	44.5	21	0	0	0	1	21	49	16.0	
30-39	34.5	16	-1	-16	16	9	144	28	16.3	
20-29	24.5	12	-2	-24	48	19	228	12	7.3	
10-19	14.5	0	-3	0	0	29	0	0	4.0	
0-9	4.5	0	-4	0	0	39	0	0	0.0	0

N = 70

$$\sum fx = -7$$

$$\sum fx^2 = 125$$

$$\sum f | d | f = 714$$



Measures of Central Tendency, Variability and Divergence  
from Normality.

Mean	=	43.5
Median	=	42.83
Mode	=	41.49
Quartile Deviation	=	10.92
Mean Deviation	=	10.62
Standard Deviation	=	13.00
Skewness in Terms of Percentile	=	1.46
Kurtosis	=	0.29

Reliability of Mean, Median, Standard Deviation, Skewness and Kurtosis.

Reliability of Mean:-

$$\sigma_M = \frac{\sigma}{\sqrt{N}} = \frac{13}{\sqrt{70}} = 1.553$$

T.M. lies between  $43.5 \pm 1.96 \times 1.553$  or  $40.45 \pm 46.55$   
at 0.05 level  
and do  $43.5 \pm 2.58 \times 1.553$  or  $39.49 \pm 47.51$   
at 0.01 level

Reliability of Median:-

$$\sigma_{Mdn} = \frac{1.253\sigma}{\sqrt{N}} = \frac{1.253 \times 13}{\sqrt{70}} = 1.946$$

T.Mdn lies between  $42.83 \pm 1.96 \times 1.946$  or  $39.01 \pm 46.65$   
at 0.05 level  
and do  $42.83 \pm 2.58 \times 1.946$  or  $37.81 \pm 47.85$   
at 0.01 level.



Reliability of SD:-

$$\sigma_{\sigma} = \frac{0.71 \sigma}{\sqrt{N}} = \frac{0.71 \times 13}{\sqrt{70}} = 1.104$$

T.SD lies between  $13.0 \pm 1.96 \times 1.104$  or 10.84 & 15.16  
at 0.05 level

and do  $13.0 \pm 2.58 \times 1.104$  or 10.15 & 15.85  
at 0.01 level

Reliability of Skewness:-

$$\begin{aligned} \sigma_{3K} &= \frac{0.5185 D}{\sqrt{N}} = \frac{0.5185 (P_{90} - P_{10})}{\sqrt{N}} \\ &= \frac{0.5185 \times 37.92}{\sqrt{70}} = 2.353 \end{aligned}$$

$$C.R = \frac{1.46}{2.353} = 0.6205$$

0.6205 is less than 1.96 at 0.05 level

and do 2.58 at 0.01 level

Hence the Skewness of 1.46 is insignificant.

Reliability of Kurtosis:-

$$\sigma_{Ku} = \frac{0.28}{\sqrt{70}} = 0.03347$$

$$C.R = \frac{(0.29 - .263)}{0.03347} = 0.8069$$

0.8069 is far below 1.96 at 0.05 level

and do 2.58 at 0.01 level

Hence there is no real divergence from the normal.



Table  
Frequency Distribution Chart for Six Groups Showing the  
Measures of Central Tendency and V a r i a b i l i t y.

Class- Inter- val..	Entire Group.	Rural	Urban	Indus- trial.	Kannada Medium.	English Medium
1	2	3	4	5	6	7
90 - 99	4	0	2	2	0	4
80 - 89	39	13	20	6	16	23
70 - 79	175	69	81	25	102	73
60 - 69	312	150	120	42	208	104
50 - 59	387	179	162	46	276	111
40 - 49	416	185	179	52	253	163
30 - 39	340	136	154	50	197	143
20 - 29	252	115	103	34	100	152
10 - 19	87	42	36	9	25	62
0 - 9	11	2	9	0	1	10
N	2023	891	865	266	1178	845
Mean	47.28	47.17	47.17	48.03	49.47	44.23
Median	47.23	47.64	46.82	47.19	49.97	42.90
Mode	47.13	48.58	46.12	45.51	50.97	40.24
Quartile Deviation	13.10	12.94	13.09	13.66	11.48	15.09
Mean De- viation	14.42	14.10	14.6	14.75	12.95	15.69
Standard Deviation	17.34	16.91	17.49	17.55	15.50	19.20





Frequency Distribution Table for Eight Groups Showing  
The Measures of Central Tendency and Varia-  
bility.

Class Interval	Boys	Girls	Rural Boys	Urban Boys	Indus-trial Boys	Rural Girls	Urban Girls	Indus-trial Girls.
1	2	3	4	5	6	7	8	9
90-99	4	0	0	2	2	0	0	0
80-89	35	4	12	17	6	1	3	0
70-79	147	28	59	65	23	10	16	2
60-69	264	48	136	94	34	14	26	8
50-59	295	92	144	116	35	35	46	11
40-49	288	128	145	112	31	40	67	21
30-39	224	116	102	88	34	34	66	16
20-29	167	85	87	58	22	28	45	12
10-19	70	17	40	21	9	2	15	0
0- 9	7	4	2	5	0	0	4	0
N	1501	522	727	578	196	164	288	70
Mean	48.68	43.25	47.76	49. 5	49.65	44.56	42.45	43.50
Mdn.	49.31	42.55	48.64	49.93	50.07	44.00	41.60	42.83
Mode	50.57	41.15	50.40	50.79	50.91	42.88	39.90	41.49
Q.D.	13.48	11.20	13.34	13.34	14.70	11.09	11.46	10.92
M.D.	14.82	11.92	14.49	19.78	18.68	11.72	13.22	10.62
S.D.	17.71	15.56	17.86	17.86	18.52	14.80	16.40	13.00



Validity.

In any satisfactory measuring instrument, two important qualities are indispensable. These are.-

1. Validity
2. Reliability.

Validity.-

The validity of a test depends upon the extent to which a test measures what it purports to measure. In a word validity means truthfulness. Validity is the most important characteristic of a good test. If a test lacks validity it is useless. "A test of low validity is a test that claims to test one thing but really tests another. A situation which makes it about as useless as the judgement of a doctor<sup>1</sup> who mistakes malaria for diabetes"<sup>1</sup>. Validity is always specific in relation to some definite situation. It is not a general criterion of an examination. A test may be highly valid in one situation and invalid for use in another.

In examining the validity of an Achievement test, a distinction should be made between curricular validity and statistical validity. Curricular validity, implies the extent to which the content of the test is truly representative of the content of the course. It implied proper sampling of the essential materials employed in instruction.

---

1. Mensel, F.W. "Suggestions for the use of New Type Tests in India", 1939, page 41.



This has been discussed while dealing with Test construction.

### Statistical Validity.-

"This refers to the mathematical processes for determining the degree to which the test agrees or correlates with some criterion which is set up as an acceptable measure of the thing in question".<sup>1</sup> The statistical procedures aim at validating the test as a whole and the items individually. The validation of the individual test items is taken up during item analysis and selection depending upon the difficulty value and discriminating index of each item. The question remaining over is the validation of the test as a whole.

Statistical validity takes into account the relation between the test scores and such external criteria as class marks rating by subject teacher and pupils marks in some other test constructed for the same type of use. The criterion must be an objective measure in terms of which the test is estimated. In our country we do not have suitable standardized tests <sup>of</sup> intelligence or achievement. The only available data are the class marks (tests and examinations) of the pupils in a given subject. They have to be correlated with the test marks. In this investigation the class marks of the pupils in General Science were correlated

---

1. Ross & Stanley: "Measurements in To-days' Schools", page 112.



with their test marks. (The number of pupils selected for this validation was 404 got by selecting every 5th pupil from the total sample of 2023) in a scattergram vide Table /<sup>page</sup> 144 and 'r' the coefficient of correlation was worked out by using the formula.--

$$r = \frac{\sum \frac{x' y'}{N} - \sigma_x \sigma_y}{\sigma_x \times \sigma_y}$$

The value of 'r' was found out to be 0.587. The reliability of the obtained validity was tested against the Null hypothesis by finding the critical ratio which is 14.43. This is far higher than 2.58 the necessary critical ratio required for the correlation to be significant at 0.01 level. "Validity coefficient for composite - scores based upon combination of several different kinds of tests are likely to be distinctly higher than 0.6 ranging up to 0.8 in rare instances but hardly ever above the latter".<sup>1</sup> "r from  $\pm .4$  to  $\pm 0.70$  denotes marked relationship".<sup>2</sup> Therefore it may be concluded that there is a <sup>marked</sup> positive relationship between the marks obtained in the test and the class marks in general science. Hence the test measures achievement in General Science. Therefore the test is valid.

- 
1. Guilford: "Fundamental Statistics in Psychology and Education", page 146.
  2. Garret: "Statistics in Psychology and Education", page 17.





Score in Achievement Test.

	0 - 9	$f_y$	$y'$	$f_y y'$	$f_y (y')^2$	$x' y'$
1	2	12	13	14	15	16
90 - 99		1	5	5	25	20
80 - 89		6	4	24	96	66
70 - 79		30	3	90	270	210
60 - 69	2 (-12)	69	2	138	276	134
50 - 59		87	1	87	87	17
40 - 49	1	79				
30 - 39		71	-1	-71	71	41
20 - 29	1 (6)	48	-2	-96	192	100
10 - 19		12	-3	-36	108	39
0 - 9		1	-4	-4	16	4

$$f_x = 4 \quad 404 \quad \sum f_y y' = 137 \quad \sum f_y y'^2 = 1301 \quad \sum x' y' = 621$$

$$x' = -3$$

$$f_x x' = -12$$

f

Calculation of "r"

$$r = \frac{(\sum x' y' / N - \bar{x} \bar{y})}{\sigma_x \sigma_y}$$

$$r = \frac{(1.54 - 0.0562)}{(1.54 \times 1.64)}$$

$$\sum x' y' / N = 621 / 404 = 1.54$$

$$\bar{x} = \sum x' / N = 67 / 404 = 0.166$$

$$(\bar{x})^2 = 0.0275$$

$$\bar{y} = \sum f_y y' / N = 137 / 404 = 0.339$$

$$(\bar{y})^2 = 0.1149$$

$$\sigma_x = \sqrt{\left\{ \sum x'^2 / N - (\bar{x})^2 \right\}}$$

$$= \sqrt{(2.42 - 0.0275)}$$

$$= \sqrt{2.3925}$$

$$\sigma = \sqrt{\left\{ \sum f_y (y')^2 - (\sum f_y y')^2 / N \right\}}$$



Inter Correlation Coefficients of Six Sub-Tests in  
The Battery.

Sub-Tests.	T.F.	M.C.	Matching	Comple- tion..	Classi- fica- tion.	Analo- gies.
1	2	3	4	5	6	7
1 True-False		0.44	0.434	0.52	(0.24)	0.455
	$r_{12} = 0.027$		0.027	0.026	0.032	0.028
2 Multiple Choice			(0.81)	0.47	0.40	0.47
			0.012	0.026	0.028	0.026
3 Matching				0.47	0.36	0.48
				0.026	0.029	0.026
4 Completion					0.43	0.55
					0.027	0.023
5 Classification						0.55
						0.023
6 Analogies						



As the class marks obtained by the pupils are prone to the subjective some other methods were also employed to estimate the validity of the test. The validity of the test was estimated in an indirect way. The marks received by the selected 404 pupils in the different test were correlated and the coefficient of correlation between 15 combination were calculated by the product moment method. Except in the case of true false and classification and multiple choice and matching in all other cases it is about 0.50. To find out the reliability of 'r' for these combinations the P.E. for each was calculated vide table <sup>on page 145</sup>  $\lambda$ . The values of 'r' for every combination are far higher than - four times the probable error. Hence 'r' is reliable.

The validity of the test was also calculated with reference to the subject teachers estimate. As the subject teachers are not able to classify pupils satisfactorily on the five points scale, the teachers of General Science were requested to name ten best and ten worst students in General Science, among those who took this test. Thus two distinct groups of students the best and the worst were got as per the teachers estimate. The scores of fifty pupils of each of these two distinct groups in this test were tabulated and their means and standard deviation calculated. The mean of the best group is 69 and that of the worst is 38.5.



# Frequency Distribution to calculate the Diserial 'r'

a.i	Mid. pt.	f of best	x	fx	fx <sup>2</sup>	Mid. pt.	f of worst.	x	fx	fx <sup>2</sup>
1	2	3	4	5	6	7	8	9	10	11
92-96	94	2	4	8	32					
87-91	89	0	3	0	0					
82-86	84	2	2	4	8					
77-81	79	7	1	7	7					
72-76	74	11	0	0	0					
67-71	69	9	-1	-9	9					
62-66	64	8	-2	-16	32	64	1	4	4	16
57-61	59	4	-3	-12	36	59	3	3	9	27
52-56	54	4	-4	-16	64	54	2	2	4	8
47-51	49	3	-5	-15	75	49	7	1	7	7
42-46	44					44	8	0	0	0
37-41	39					39	7	-1	-7	7
32-36	34					34	6	-2	-12	34
27-31	29					29	6	-3	-18	54
22-26	24					24	9	-4	-36	144
17-21	19					19	1	-5	-5	25
						$\sum fx = -54$ $\sum fx^2 = 322$				
						$N=50$ Mean = 38.6 SD = 11.4				
						$\sum fx = -49$ $\sum fx^2 = 263$				
						Mean = 69.1 SD = 10.4				





Frequency Distribution of the fifty best and the fifty  
worst combined together

c.i.	M.P	f	x	fx	fx <sup>2</sup>
1	2	3	4	5	6
92-96	94	2	7		
		7	8	14	98
87-91	89	0	6	0	0
82-86	84	2	8	10	50
77-81	79	7	4	28	112
72-76	74	11	3	33	99
67-71	69	9	2	18	36
62-66	64	9	1	9	9
57-61	59	7	0	0	0
52-56	54	6	-1	-6	6
47-51	49	10	2	-20	40
42-46	44	8	-3	-24	72
37-41	39	7	-4	-28	112
32-36	34	6	-5	-30	150
27-31	29	6	-6	-36	216
22-26	24	9	-7	-63	441
17-21	19	1	-8	-8	64

N=100

 $\sum fx = -103$  $\sum fx^2 = 1506$ 

M = 53.95, SD = 18.75.

$$r_{bis} = \frac{M_p - M_t}{S} \times \frac{P}{Z}$$

$$= \frac{69.1 - 53.95}{18.75} \times \frac{.50}{.399} = .9875$$

$$\sigma_{r_{bis}} = \left( \sqrt{\frac{pq}{Z}} - r_{bis}^2 \right)$$

$$\frac{1}{\sqrt{N}} = 0.1053$$

where  $M_t$  is the mean of the total group (100)  $M_p$  is the mean of the best group, P is the proportion of the best group, Z = height of ordinate separating the two groups.



The reliability of this difference was found out by calculating the critical ratio. The critical ratio is 14.00. This value of C.R. is many times higher than 1.96 and 2.58 at both the level of significance. Hence the difference between the two groups is highly significant. The test scores have correlated very well with the subject teachers estimate of the pupils. Hence this test <sup>does</sup> measure achievement in General Science. Therefore it is valid.

The biserial coefficient of correlation was also calculated for these two distinct groups. It is as high as 0.9875 with a S.E. of 0.1953. This shows that the test <sup>does</sup> measure achievement in General Science. Therefore the test is valid.



Reliability.

The other important quality of a measuring instrument is reliability when validity deals with measuring - what it proposes to measure, reliability deals with measuring it consistently. "Reliability means consistency. By itself consistency or reliability is a doubtful virtue for a test or a person might be consistently wrong, but its absence is a sign of weakness. Although high reliability is no guarantee that the test is good, low reliability does indicate that it is poor".<sup>1</sup> When a test is reliable, scores made by a member of a group - upon re-test with the same test or with alternate forms of the - same test may differ very little or not at all from the original. It implies precision or accuracy. However it is influenced by such factors as (a) limited sampling of items, (b) subjective scoring, (c) distraction, (d) changes in physical and psychological conditions, (e) motivation (f) and/guessing

In the present investigation many of the above factors were controlled satisfactorily. Though controlling of these factors seem to assure reliability it is not certain till the test results are verified. There are different methods of estimating the reliability of a test.

(1) The Test re-test Method:-

This is the simplest method of determining reliability

- 
1. Ross & Stanley: "Measurement in To-days' Schools", pages 22.



the test is given and repeated on the same group at a later date and the extent of agreement by computing the coefficient of correlation between two series of scores is found out.. This method has many limitations such as the same conditions to be maintained for repeated administration of the test, the influence of time factor etc.. This is not a common method. Moreover the method could not be used in this investigation as the test could not be re-tested.

2. The other method is the Alternative or Parallel Forms Method.

Two parallel forms of the same test are constructed and administered to the same pupils after a sufficient interval of time to weaken memory and practice effects. The coefficient of correlation is calculated between the two sets of scores and the agreement between the two forms of the test is found out. This method was also not resorted to.

*Split Half Method :-*

3. There is yet another method of estimating Reliability. This is termed the split -half method. In this method the test is broken into two equal halves composed of odd numbered items and even numbered items. The correlation between the scores of the two halves of the test is regarded as an estimate of half test reliability. The reliability of the entire test is found out by using the Spearman - Brown prophecy formula.-





Odd Scores      Scattergram

	0 - 9	10 - 19	20 - 29	30 - 39	40 - 49	$f_o$	$x$	$f_o x$	$f_o x^2$	$xy$
1	2	3	4	5	6	7	8	9	10	11

10-19      12      10      22      2      44      88      64

(24)      (40)

30-39      35      100      11      146      1      146      146      128

(100)      (22)

20-29      20      115      23      158      0      0      0

Even scores.

10-19      3      48      23      74      -1      -74      74      54

(6)      (48)

0-9      2      2      2      4      -2      -8      16      18

(4)

$f_o$       5      70      173      135      21       $N = 404$        $\sum f_o x = + 108$        $\sum f_o x^2 = 284$        $\sum xy = 282$

$y$       -2      -1      0      1      2

$f_o y$       -10      -70      0      135      42       $\sum f_o y = + 97$

$f_o y^2$       20      70      0      135      44       $\sum f_o y^2 = 269$

$xy$       14      52      0      124      62       $\sum xy = 252$



$$r = \frac{\frac{\sum x' y'}{N} - c_x c_y}{\sqrt{\frac{\sum x'^2}{N} - c_x^2} \sqrt{\frac{\sum y'^2}{N} - c_y^2}} \quad \frac{\sum x' y'}{N} = \frac{252}{404} = 0.621$$

$$c_x = \frac{\sum f_x}{N} = \frac{108}{404} = 0.26$$

$$c_y = \frac{\sum f_y}{N} = \frac{97}{404} = 0.24$$

$$o_x = 1 \sqrt{\frac{\sum f_x^2}{N} - c^2} \quad c_x \times c_y = .26 \times .24 = 0.0624$$

$$= 1 \sqrt{\frac{324}{404} - (.26)^2} = 1 \sqrt{0.802 - 0.0676}$$

$$= 1 \sqrt{0.7344} = 1 \times 0.86$$

$$o_y = 1 \sqrt{\frac{\sum f_y^2}{N} - c^2} = 1 \sqrt{\frac{269}{404} - c^2}$$

$$= 1 \sqrt{.6658 - 0.0576} = 1 \sqrt{0.6082} = 1 \times 0.78$$

$$r = \frac{0.624 - 0.0624}{.86 \times .78} = \frac{0.5616}{0.6708} = \underline{0.84}$$

$$r_{11} = \frac{2 r_{12}}{1 + r_{12}} = \frac{2 \times .84}{1 + .84} = \frac{1.68}{1.84} = \underline{0.91}$$

Spearman Brown formula

The index of reliability:-

$$r_{\infty} = \sqrt{r_{11}} = \sqrt{0.91} = \underline{0.95}$$



This method lays emphasis on the inter correlation of the items in the test and the correlations of the items in the test as a whole. There are many formulas for determining test reliability of which the most useful is -

$$r_{11} = \frac{n}{(n-1)} \times \frac{\sigma_x^2 - \sum pq}{\sigma_x^2} \quad \text{in which?}$$

$r_{11}$  = reliability coefficient of the whole test.

$n$  = number of items in the test

$t$  = the .p. of the test scores.

$p$  = proportion of the group answering an it correctly

$q = (1 - p)$  proportion of the group answering on it incorrectly.

In this investigation the estimations of reliability is made by the split half method, as the first two methods were not feasible. 404 random cases were selected out of the total number of 2023 cases. Every fifth cases was drawn from the orderly arranged entire sample. The test was divided into halves, the odd numbered items making one half and the even number items, the other. A scattergram was drawn (vide table) for computing the correlation coefficient and it was determined by the product moment formula. The reliability coefficient of the whole test is 0.91.

#### Index of Reliability.

"It measures the trust worthiness of test scores



c.t.	f	x	fx	fx <sup>2</sup>
90-99	0	4	0	0
80-89	5	3	15	45
70-79	30	2	60	120
60-69	71	1	71	71
50-59	86	0	0	0
40-49	79	-1	-79	79
30-39	72	-2	-144	288
20-29	48	-3	-144	432
10-19	12	-4	-48	192
0-9	1	-5	-5	25
<b>Σf</b>	<b>404</b>		<b>fx = -274</b>	<b>fx<sup>2</sup> = 1252</b>

$$\sigma = \frac{1}{N} \sqrt{\frac{fx^2}{N} - \sigma^2}$$

$$= \frac{1}{404} \sqrt{\frac{1252}{404} - 3.098}$$

$$r_{11} = \frac{n}{n-1}$$

$$= \frac{120}{119} \times \frac{263.56 - 111.9}{263.56}$$

$$cx = \frac{-274}{404} = -0.68$$

$$= \frac{120}{119} \times \frac{238.76}{263.56}$$

$$\sigma^2 = 0.4624$$

$$\sigma = \sqrt{3.98 - .4624} \times 10 = 0.91$$

$$= 10 \sqrt{2.6356}$$

$$= 100 \times 2.6356$$

$$= 263.56$$





formula.--

$$r_{11} = \frac{2 r_{\frac{1}{2}} \frac{1}{11}}{1 + r_{\frac{1}{2}} \frac{1}{11}}$$

where  $r_{11}$  = the reliability coefficient of the whole test.

$r_{\frac{1}{2}} \frac{1}{11}$  = the reliability of coefficient of one half of the test found experimentally.

The split half is regarded as the best of the methods for determining test reliability. This can be used when it is not feasible to construct a parallel form of the test or to repeat the test. It excludes the creeping in of variations in two testing conditions.

The split half method is criticised on the ground that the test can be divided into two halves in a variety of ways so that the reliability coefficient is not a unique value. "When items are placed in order of difficulty the split into odds and evens gives a unique determination of the reliability coefficient".<sup>1</sup>

L.F. Kuder and R.W. Richardson have developed a formula for determining the reliability of a test without calculating the coefficient of correlation and free from the objections raised against the other methods. This method is called "The Method of Rational Equivalence".

---

1. Garret H.E. "Statistics in Psychology and Education", page 334.



by showing how well obtained scores agree with their theoretical true counterparts. It gives the maximum correlation which the given test is capable of yielding"<sup>1</sup> The index of reliability in this case is 0.95

"A test whose index of reliability is only 0.50 is an extremely poor estimate of the function which it is trying to measure"<sup>2</sup>

Since the index of reliability in the present test is 0.95 it might be said that the test measures Achievement in general science satisfactorily well.

Reliability was calculated by the Rational equivalence method also. vide table on page 154 and the Reliability coefficient was determined to be 0.91. Since the reliability of the test by both the methods is 0.91 and the index of reliability is as high as 0.95, Therefore the test can be taken as highly reliable.

---

1. Garret. "Statistics in psychology and Education", page 342.

2. Ibid.







Test Norms.

A norm is an estimate of some characteristic of the distribution of scores for a specific population. "One of the major uses claimed for educational achievement tests is 'evaluation' of the content and organization of the curriculum and of the quality of effectiveness in instruction in individual schools. This implies an evaluation of group, rather than of individual pupil performance. What is needed for this purpose obviously, is a type of norms that is descriptive of distribution of measures of group achievement, that is of school averages, rather than of distributions of individual pupil scores".<sup>1</sup> There are several kinds of norms, such as age norms, grade norms and percentile norms.

Grade Norms state the mean score obtained by each of the several groups classified according to school grade.

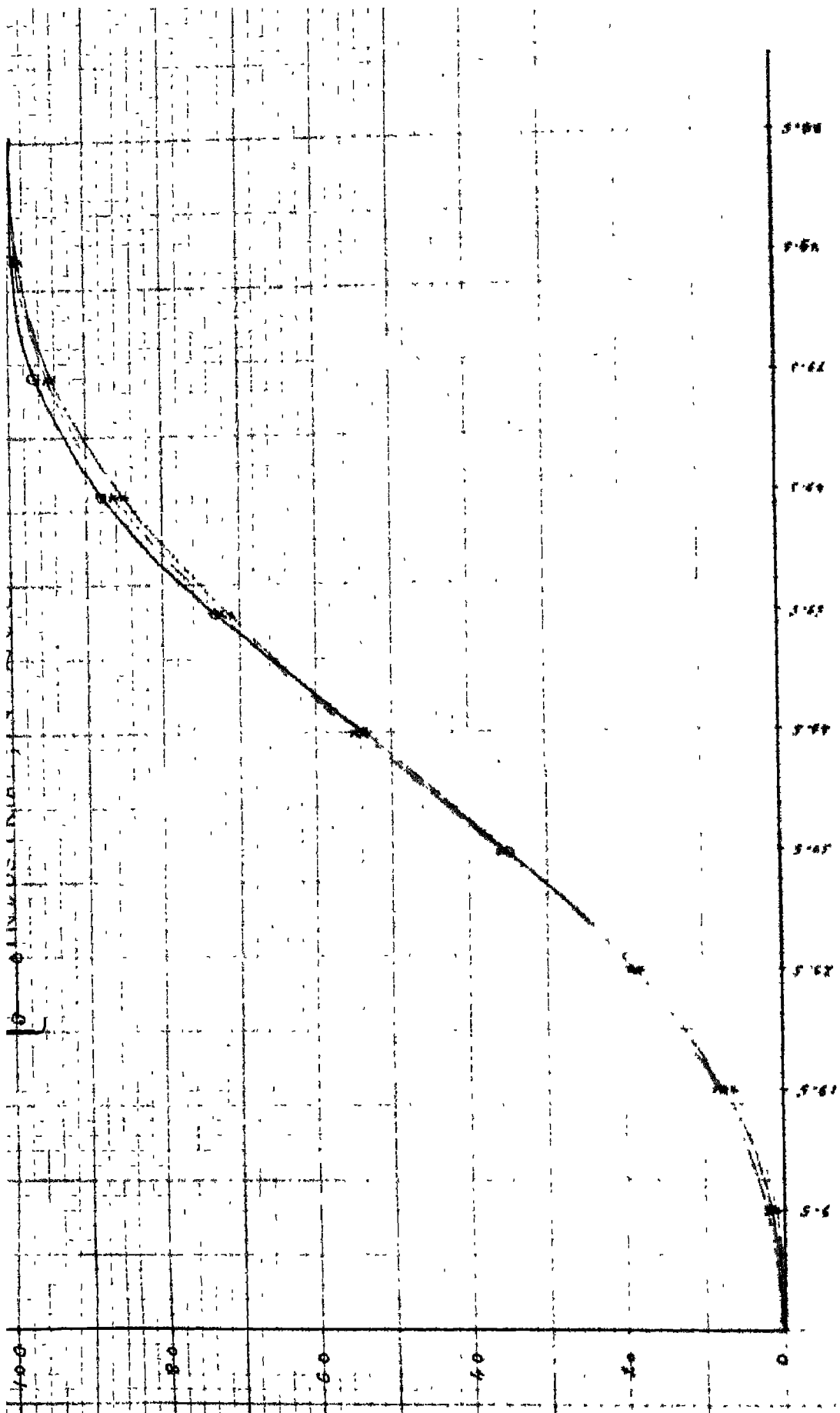
Percentile norms state the percentile to which a given score corresponds in some specified reference group.

Grade norms and percentile norms have been calculated in this investigation. The mean calculated for the entire sample is 47.28. This can be taken as the norm of the specified group in this Achievement Test. The norms of the various groups have been calculated and given in table on pages 139 and 140. (page 164)

Percentile norms have also been calculated. They are estimated graphically also by the help of the ogive drawn for the entire sample.

---

1. Lindquist:





Comparison of Groups.

In order to find out the level of achievement of the various sub-groups in this sample the reliability of their average performance has to be found out and the significance of the difference if any has to be established. In this investigation the average performances of the following groups have been compared and the significance of the difference if any, has been calculated. This has been represented graphically also.

Urban, Rural, Industrial, Boys, Girls and English & Kan. Medium.

Statement showing the Mean and S.D of the Different Groups.

Group.	Mean	S.D.
Urban	47.17	16.91
Rural	47.17	17.49
Industrial	48.03	17.55
Boys	48.68	17.71
Girls	43.25	15.56
Rural Boys	47.76	17.86
Urban Boys	49.50	17.86
Industrial Boys	49.65	18.52
Rural Girls	44.56	14.80
Urban Girls	42.25	16.40
Industrial Girls	43.50	13.00



Reliability of Difference between Means:

1) Rural and Urban:-

$$\text{Mean for Rural} = 47.17$$

or

$$\text{Mean for Urban} = 47.17$$

$$\text{Difference} = \underline{\underline{0}}$$

ii) Urban and Industrial:-

$$M_1 = \text{Mean for Urban} = 47.17$$

$$M_2 = \text{Mean for Industrial} = \underline{\underline{48.03}}$$

$$\text{Difference} = \underline{\underline{0.86}}$$

$$\sigma_D \text{ or } \sigma_{M_1 - M_2} = \sqrt{\sigma_{M_1}^2 + \sigma_{M_2}^2}$$

where  $\sigma_{M_1}$  is the S.E. of first Mean and  $\sigma_{M_2}$  is the S.E. of the second Mean.

$$M_1 = 0.594; \quad M_2 = 1.076$$

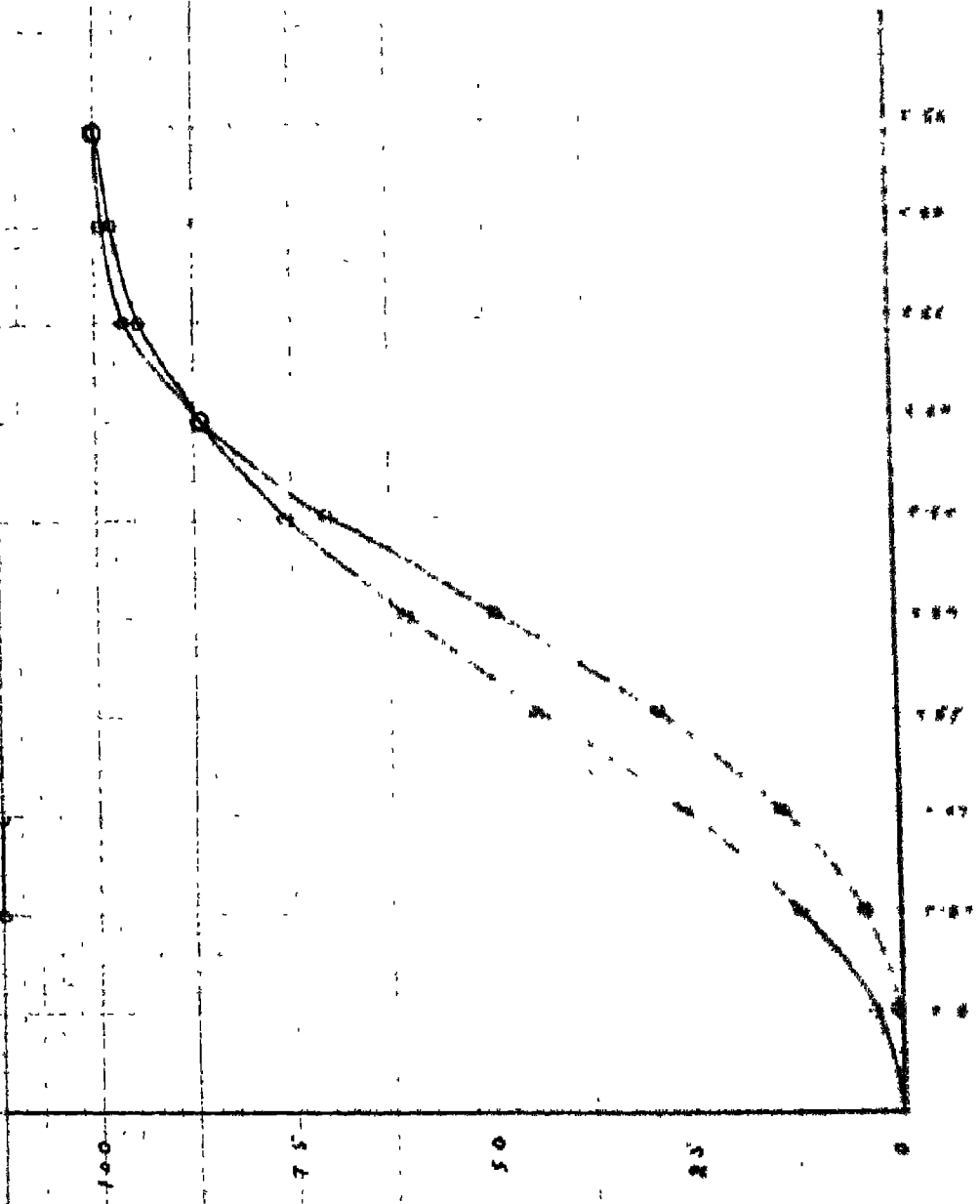
$$\begin{aligned} \text{Therefore } \sigma_D &= \sqrt{(.594)^2 + (1.076)^2} \\ &= \sqrt{1.5109} = 1.229 \end{aligned}$$

$$\text{Therefore C.R.} = \frac{D}{\sigma_D} = \frac{0.86}{1.229} = 0.93$$

This is much below 1.96 and 2.58 at the .05 and .01 levels of confidence. Hence the difference of 0.86 between the two means is not significant.

ENGLISH MEDIUM: N-845

KANNADA MEDIUM: N-1178



## iii) Industrial and Rural.-

	<u>Industrial</u>	<u>Rural</u>
Mean	48.03	47.17
Difference	48.03 - 47.17 = 0.86	

$$\sigma_{M_1} = 1.0760$$

$$\sigma_{M_2} = 0.5665$$

$$\begin{aligned} \text{Therefore } \sigma_D &= \sqrt{\frac{\sigma^2}{N_1} + \frac{\sigma^2}{N_2}} = \sqrt{\frac{(1.076)^2}{1} + \frac{(0.5665)^2}{1}} \\ &= \sqrt{1.157 + 0.321} = \sqrt{1.478} = 1.216 \end{aligned}$$

$$\text{Therefore i.e. } \frac{D}{\sigma_D} = \frac{0.86}{1.216} = 0.707$$

Hence the difference of 0.86 between the two means is of no significance.

## iv) Kannada Medium and English Medium.-

	<u>Kannada.</u>	<u>English</u>
Mean	49.47	44.23
Difference	5.24	

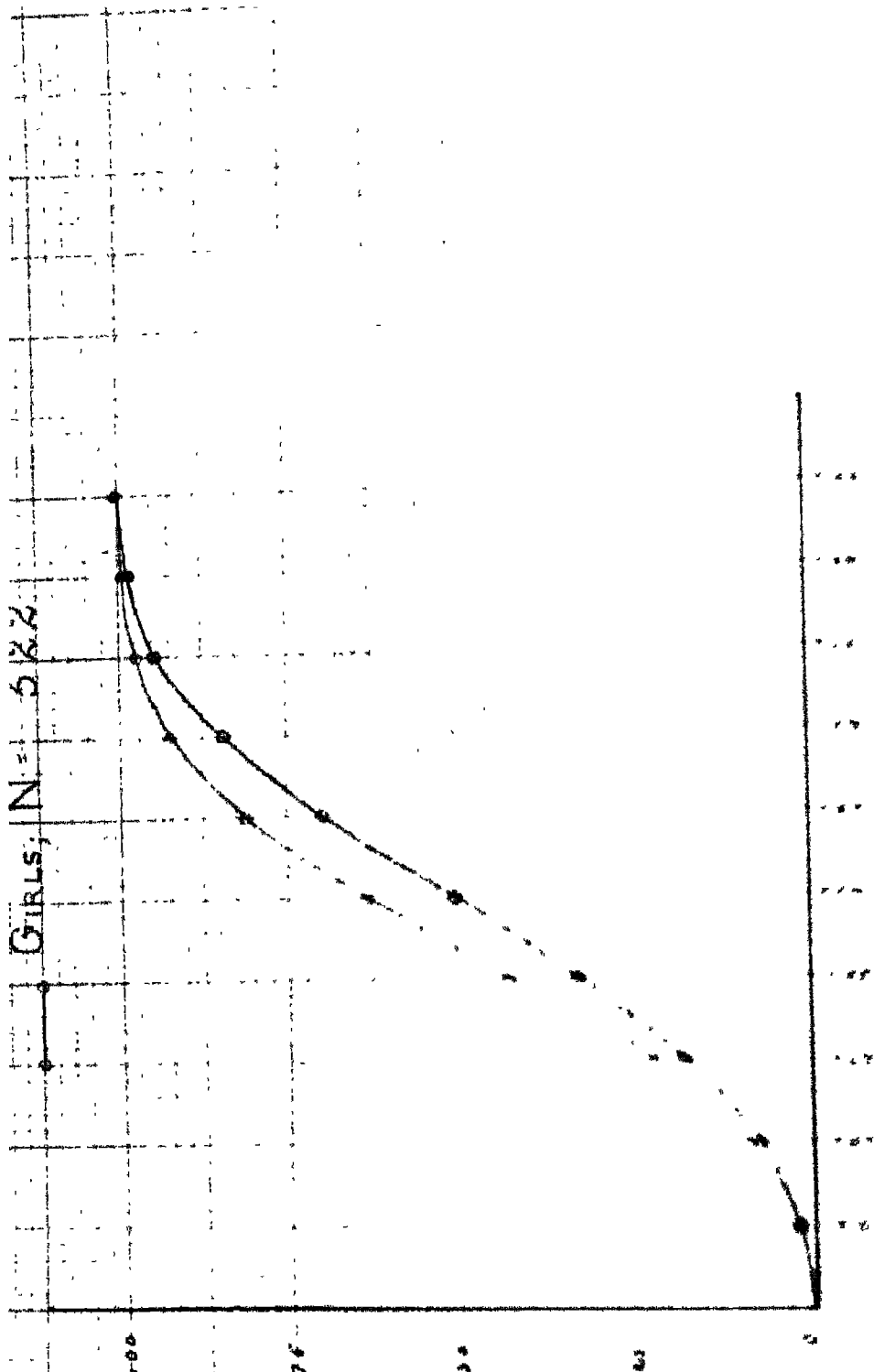
$$\sigma_{M_K} = 0.4516 \quad \sigma_{M_E} = 0.6604$$

$$\begin{aligned} \text{Therefore } \sigma_D &= \sqrt{\frac{(0.4516)^2}{1} + \frac{(0.6604)^2}{1}} = \sqrt{0.204 + 0.436} \\ &= \sqrt{0.64} = 0.8 \end{aligned}$$

$$\text{Therefore i.e. } \frac{5.24}{0.8} = 6.55$$

Hence the difference of 5.24 between the two means is significant at both the .05 and .01 levels of significance.

Explanation:-



Explanation:-

This shows that the performance of the Kannada medium candidates is decidedly better than that of the English medium candidate. This may be due to the language difficulty which the English medium candidates encounter. The question of understanding the subject depends upon understanding the language in which it is taught. A sudden change over from the medium of instruction in Kannada, Tamil or Urdu to English confounds the pupils.

## v) Boys and Girls:-

	<u>Boys</u>	<u>Girls.</u>
Mean	48.68	43.25
Difference	<u>5.43</u>	

$$\sigma_{M_1} = 0.4571; \quad \sigma_{M_2} = 0.6870$$

$$\text{Therefore } \sigma_D = \sqrt{(0.4571)^2 + (0.6870)^2} = \sqrt{0.6810}$$

$$= 0.8252$$

$$\text{Therefore J.R.} = \frac{5.43}{0.8252} = 6.58 \text{ is greater than}$$

1.96 and 2.58 at both levels of significance.

Therefore the difference is significant.

Explanation:-

Girls are shy by nature and suffer from inferiority complex. Even if they do not understand any thing they do not demand a clarification just to conceive conceal their ignorance. Therefore more often than not they rely upon textual information and memory. In addition to these a part of their time is used up in attending to domestic affairs.





## CHAPTER - VI

### Summary of Conclusions and Suggestions for Further Work.

The level of attainment in school subjects is satisfactorily assessed by Standardized Achievement Tests. In our country such tests are not available. Very few - attempts have been made so far in this direction. The present study is a humble attempt to satisfy this need to a - little extent in the subject of General Science.

#### A. Summary of Conclusions.

1. In this standardized test of achievement the distribution of the scores of the entire group as well as the sub-groups almost fit in the normal probability curve. This proves that the technique adopted in this measurement is - correct and objective.

2. The efficiency of the test is determined in terms of its reliability and validity.

##### a) The Reliability of the Test:-

1) By split-half method	..	0.91
2) By Rational Equivalence Method.		0.91
Index of Reliability	..	0.95

Hence the test is highly reliable.

##### b) The validity of the test.-

1) Comparing test marks with class marks	..	..	0.587
--	----	----	-------



- 2) Finding the significance of difference between 50 best and 50 worst students as per the teachers' rating estimate.

a) Difference between their means .. 30.50

b) Critical Ratio .. .. 14.00

The difference is highly significant.

- 3) The biserial coefficient of correlation

between the best and worst students .. 0.9875  
as estimated by the subject teachers.

S.E. of  $r_{bis.}$  .. .. 0.1953

Hence the test is valid.

- 3 Norms:- These have been established in two forms:

(1) Mean Norms, (2) Percentile Norms.

1) Mean Norms.

<u>Group.</u>	<u>Mean</u>	<u>S.D.</u>
a) Entire sample	47.28	17.34
b) Rural Group	47.17	16.91
c) Urban Group	47.17	17.49
d) Industrial Group	48.03	17.55
e) Kannada Medium	49.47	15.50
f) English Medium	44.23	19.20
g) Boys	49.31	17.71
h) Girls	43.25	15.56



2) Percentile Norms.

a)	p <sub>5</sub>	..	19.63
b)	p <sub>10</sub>	..	23.64
c)	p <sub>20</sub>	..	31.10
d)	p <sub>25</sub>	..	34.10
e)	p <sub>30</sub>	..	36.09
f)	p <sub>40</sub>	..	42.40
g)	p <sub>50</sub>	..	47.23
h)	p <sub>60</sub>	..	52.30
i)	p <sub>70</sub>	..	57.50
j)	p <sub>75</sub>	..	60.30
k)	p <sub>80</sub>	..	63.50
l)	p <sub>90</sub>	..	70.40
m)	p <sub>95</sub>	..	76.30

4

Comparison of Groups.

- (1) Rural and Urban: There is no difference between the performance of the Rural and Urban students.
- (2) Industrial and Urban. There is a slight difference of 0.86 between the performance of the Industrial and Urban students. But it is not significant.
- ( 3) Industrial and Rural. There is a slight difference of 0.86 between the performance of the Industrial and Rural students. But it is not significant.



(4) Kannada Medium and English Medium.

There is a significant difference of 5.24 between the performance of Kannada Medium and English Medium students. The performance of Kannada Medium pupils is superior to that of English Medium ones.

(5) Boys and Girls.

There is a difference of 5.80 between the performance of boys and girls. The difference is highly significant. The performance of the boys is superior to that of the girls.

B. Suggestions for Further Work.

1. The present test is constructed and standardized for High School I Year class (ex-Mysore area) based upon the syllabus of 1956. This syllabus has since been revised. As a consequence the test has to be modified to suit the new syllabus and then standardized on a larger scale drawing a more representative sample from the several parts of new - Mysore State. Considering the magnitude of the work, this has to be taken up by the Bureau of Research of the Department of Public Instruction, Mysore.

2. This is the first standardized test in General Science. It is desirable to have parallel forms of the test and standardized them. Hence other tests in general science for the same standard may be devised and standardized.

3. On the same lines Achievement tests in General Science for the remaining two standards of the High school may be constructed and standardized.

4. The present investigation reveals that there is a





significant difference between the achievement of boys and that of the girls in general science. Before any definite conclusions can be drawn this has to be further verified by administering the test on an intensive scale to larger samples of boys and girls.

5. A significant difference is also found in the performance of the Kannada Medium pupils and the English Medium pupils. This again is a finding of great importance in the field of education. Hence this aspect has also to be measured on an intensive measure.

6. The present investigation has tried to find out in a general way, if there is any difference between the performance of children of Urban, Rural and Industrial areas. But it would be of interest to obtain further details about the occupation of the parents and find out the relative performance of children coming from different occupational homes.



## Appendix A,

### 3 (a) PHYSICS

#### I YEAR - Two periods a week.

#### 1) Study of the general properties of matter:-

Occupies space, transfers motion, offers resistance, has weight; divisibility, porosity, compressibility, elasticity. The three states of matter.

Special properties of solids: rigidity, tenacity, ductility, malleability, hardness.

Special properties of liquids: Definite size and no definite shape: find their level; communicate pressure equally in all directions; Water supply in rural and urban areas.

Special properties of gases: occupy all the space; have weight; exert pressure in all directions syringe, penfiller, cycle pump, inflator. Measuring the pressure of the atmosphere with a barometer.

ii) Length, units in British and Metric systems and the relations between them.

Area: Units.

Volume: units, capacity, measuring jar, pipette. Measurement of volume by displacement. (Use of graduated jar).

iii) Mass, Weight and Density: Units, measurement



of mass by the common balance; measurement of weight by the spring balance. Difference between mass and weight. Meaning of density. Determination of the density of common substances.

iv) Effect of heat on bodies: expansion. Temperature and its measurement. Construction of a thermometer. Centigrade and Fahrenheit scales. Clinical thermometer.

Transference of heat; conduction, good and bad conductors; thermos flask, convection, ventilation in buildings: radiation. Simple steam engine and - internal combustion engine.

### 3 (b) CHEMISTRY.

Chemical changes - (melting of ice or sulphur).

Chemical changes -

a) Chemical combination - (burning of sulphur, union between iron and sulphur).

b) Chemical decomposition . (Action of heat on red oxide of mercury) - Elements and compounds.

Separation of mixtures using common laboratory methods.-

Decantation, filtration, solution, evaporation and crystallisation as applied to mixtures of sand and common



salt; and iron filings and sulphur.

2. Air.- Air contains oxygen and nitrogen; a burning candle uses up oxygen; nitrogen does not support combustion; oxygen is necessary for breathing; metals heated in air increase in weight; iron rusts in moist air; composition of air by volume (burning of phosphorus in a bell jar).

3. Oxygen.- Discovery of oxygen; action of heat on potassium chlorate; preparation of oxygen by heating a mixture of potassium chlorate and manganese dioxide; - properties and uses of oxygen.

4. Water.- Natural sources of water; common impurities in water; water purification; distillation of water; water is a chemical compound; action of sodium on water; decomposition of water by an electric current; composition of water by volume (composition of water by weight is to be indicated).

5. Hydrogen.- Preparation of hydrogen by the action of dilute-sulphuric acid on zinc; properties of hydrogen; water is formed when hydrogen burns in air.

6. Carbon.- Preparation, properties and uses of charcoal; mention of the other forms of carbon (graphite and diamond) and their uses. When a candle burns in air, the products formed are water and carbon dioxide.

Revision of portions taught in the I Year \*(6 periods)





I YEAR - Two periods a week.

The parts of a typical plant like the bean.-

Root, Stem, Bud, Leaf, Flower, Fruit and Seed.

The structure and germination of the bean seed.

The soil: demonstration of its constituents - sand, clay and humus. Water and air in the soil. Water holding capacity of soils. The work of earthworms in the formation of soil.

Storage organs in plants. Vegetative reproduction. Cuttings, bulbs, tubers, rhizomes.

The external features, habits, food and life history of (1) the butter-fly or moth and (2) the frog.

The parts of the human body and a simple account of the functions of the chief organs.

The circulation of blood in man.



Appendix B

UNIVERSITY OF MYORE

TEACHERS' COLLEGE, MYSON

ACHIEVEMENT TEST IN GENERAL S S I E N C E .

(Physics, Chemistry and  
Biology)

( For High School I Year Students)

TRY-OUT

Name . . . . .  
Age . . . . . Boy/Girl. Class . . . . .  
Optional Subject . . . . . Mother Tongue .....  
Native Place: City ..... Town ..... Village .....  
School .....  
Education of Parents, Father . . . . . Mother . . .  
Income of Parents . . . . . Date . . . . .

---

INSTRUCTIONS

- 1 Fill in the above entries first.
- 2 Read the instructions given at the beginning of each test carefully, understand and then begin to answer.
- 3 Answer these questions as quickly as you can
- 4 Do not answer the questions you do not know and those about which you are doubtful.
- 5 If you cannot answer any question do not waste time. Pass on to the question next to it. You may come back to them and answer at the end if there is time.
- 6 Do not ask questions after you have started answering.

\*\*\*



## TRUE-FALSE TEST

### INSTRUCTIONS:

Some of the following statements are true and some are false. The letters T & F are printed on the left hand side of each statement. Encircle the letter 'T' if the statement is true. Encircle the 'F' if the statement is false. Do not mark statements you do not know. Do not guess. Guessing reduces your score.

### Sample examples.

(T) F 1. Honey is a viscous liquid.

T (F) 2. Charcoal is crystalline.

Statement (1) is true. Therefore a circle is put round T.

Statement(2) is false and therefore a circle is put round (F)

### Answer the following Statements as above.

T. F 1 The unit of length in the British System is called meter

T F 2 The larva of the frog is called the caterpillar

T F 3 When sodium is thrown on water oxygen is given out.

T F 4 A body weight more at the poles than at the equator

T F 5 The mass of a body is measured by balancing it - against a known mass on a pair of scales.

T F 6 Density is the mass of unit volume of a substance.

T F 7 The frog buries itself in the mud when the tank dries.

T F 8 The larva of the butterfly changes its skin 3 to 4 times.

T F 9 A graduated measuring jar is used to find the volume of a small irregular insoluble body.

T F 10 Graphite is an allotropic form of carbon.

T F 11 Adhesion denotes the attraction between the unlike particles of matter.

T F 12 A clinical thermometer is one foot long.

T F 13 The pressure of the atmosphere varies from place to place

- T F 14. When potassium permanganate is heated, hydrogen is given out.
- T F 15. Liquids have a definite shape.
- T F 16. The bean seed has a single cotyledon.
- T F 17. Sodium is kept in water.
- T F 18. Calipers (Slide) are used to measure the diameter of a cylindrical rod.
- T F 19. The right auricle receives pure blood.
- T F 20. Iodine melts when it is heated.
- T F 21. Burning of paper is a physical change.
- T F 22. Hydrogen is a supporter of combustion.
- T F 23. The wings of a butterfly are covered with scales.
- T F 24. White corpuscles have an irregular shape.
- T F 25. Heat is transmitted in liquids by conduction.
- T F 26. The movements of the body are caused by muscles.
- T F 27. Liquids flow from a higher level to a lower level.
- T F 28. An element can be split up into two or more than two simpler parts.
- T F 29. The arm region has two bones.
- T F 30. Some solids are malleable.
- T F 31. The cotyledons of bean seeds remain below the soil after germination.
- T F 32. Liquids find their own level.
- T F 33. A thermos flask is used to measure the quantity of a liquid.
- T F 34. Water kept in a mud pot cools due to vaporisation.
- T F 35. A frog is called an amphibian.
- T F 36. Corolla is a non-essential part of a flower.
- T F 37. Manganese di-oxide is a catalytic agent.
- T F 38. Matter is porous.
- T F 39. Bulb is a storage organ.
- T F 40. When a drop of water falls on the glass chimney of a lighted

- T F 41. A clinical thermometer is graduated from 95.F. to 110.
- T F 42. Mercury is a convenient liquid for thermometers.
- T F 43. The property of matter used in the construction of a  
spring balance is rigidity.
- T F 44. The object to be weighed should be kept in the left hand  
pan of a balance.
- T F 45. When the pointer of a balance swings equally on either  
side of the central point then the weights in the pans  
are balanced.
- T F 46. The part of air that supports life is Nitrogen.
- T F 47. Buds are found in the space between the primary and the  
secondary roots.
- T F 48. One inch is equal to 3 cms.
- T F 49. Hydrogen is heavier than air.
- T F 50. Sand in water can be removed by sublimation.

### Modified True-False Test

**Instructions:** Some of the following items are true and some are false. The letters T and F are printed on the left hand side of each statement. If the statement is true encircle the letter "T". If the statement is false encircle the letter "F". In ~~each~~ each statement one word is underlined. This word makes the statement true and false. If you think a statement is false it can be made "true" by changing the underlined word. Think such words and write them in the space provided on the left hand side of each statement.

**Sample Examples:** ( ) (T) F (1) The unit of mass in the British  
system is the pound.

(Verona) T (F) (2) Sponge absorbs water freely because it is elastic.

The first statement is true and so "T" is encircled. There is no need to change

the underlined word. But the second statement is false. "F" is therefore encircled. The underlined word makes the statement false. The sponge absorbs water because it is porous. So the word elastic has to be changed to "porous".

Answer the following statements as above:-

- ( ) T F 1 Sun's heat reached our body by the process of Convection.
- ( ) T F 2 The mass of a body is measured by a thermometer.
- ( ) T F 3 One or more new substances are formed in a chemical changes.
- ( ) T F 4 The part of a leaf above the stalk is called the Lamina.
- ( ) T F 5 Nitrogen is the inactive part of air.
- ( ) T F 6 Heat and light are usually produced in a physical change.
- ( ) T F 7 Joseph priestly discovered oxygen.
- ( ) T F 8 Water is easily absorbed in a claying soil.
- ( ) T F 9 Crops like ragi, jowar and pulses are raised in dry lands.
- ( ) T F 10 The frog belongs to the group of vertebrates.
- ( ) T F 11 The melting point of ice in fahrenheit scale is 32.
- ( ) T F 12 The density of water at 4.C in the metric system is one pound.
- ( ) T F 13 A rod of iron kept in fire for some time begins to burn.
- ( ) T F 14 The highest temperature that a clinical thermometer can measure is 40.F.
- ( ) T F 15 100 c.c. of a liquid is called a litre.
- ( ) T F 16 The unit of weight in the metric system is one ounce.



- ( ) T F 17. Sodium carbonate is efflorescent.
- ( ) T F 18. When iron is mixed with sulphur iron sulphide is formed.
- ( ) T F 19. Air is a mixture.
- ( ) T F 20. Diamond is an amorphous form of carbon.
- ( ) T F 21. Hydrogen is a combustible gas.
- ( ) T F 22. When sugar dissolves in water, sugar is called a solvent.
- ( ) T F 23. When hydrogen burns in air water is formed.
- ( ) T F 24. The colour of white corpuscles is due to the presence of haemoglobin.
- ( ) T F 25. The upper arm of man contains two bones.
- ( ) T F 26. A hinge joint is present between the thigh bone and the pelvic girdle.
- ( ) T F 27. Paddy plants have a tap root system.
- ( ) T F 28. The presence of earthworms in the soil is harmful to plants.
- ( ) T F 29. In salbad the food is stored in the stomach.
- ( ) T F 30. Two simple eyes are found in the head of the butter fly.

### MULTIPLE CHOICE TEST

Instructions: - Here are some incomplete statements. They can be completed by only one of the five possible answers given select the correct answer and write its number preceding it in the space provided on the left hand side of the statement.

**Example:-** (b) Stigma is a part of -- (a) Gynema (b) Pistil (c) Leaf.  
(d) Stamen (fruit) (e) pistil is  
correct therefore "B" is written in the bracket.

Similarly try the following:-

- ( ) 1. A thermometer is used to measure ----- (a) Temperature.  
(b) pressure (c) Weight (d) Height (e) Volume.
- ( ) 2. Heat is transmitted in solids by ----- (a) Convection  
(b) evaporation (c) distillation (d) sublimation.
- ( ) 3. When air is heated it ----- (a) Contracts. (b) breaks up  
(c) solidifies (d) expands (e) liquifies.
- ( ) 4. The average pulse rate of a man is ----- (a) 100 (b) 45.  
(c) 72 (d) 60 (e) 50.
- ( ) 5. The property by virtue of which solids can be  
beaten into thin sheets is called ----- (a) rigidity  
(b) tenacity (c) elasticity (d) malleability (e) ductility
- ( ) 6. The normal temperature of a human being is -----  
(a) 100. (b) 104.2 F. (c) 98.6 F. (d) 93.8 F (e) 90.3 F
- ( ) 7. Combustion is another name for ----- (a) drying. (b)  
contracting. (c) boiling (d) burning (e) melting.
- ( ) 8. Substances without crystalline shape are called -----  
(a). Dense (b) opaque (c) elastic (d) inert (e) amorphous.
- ( ) 9. Distillation is a means of ----- (a) purifying water  
(b) securing pressure (c) transmitting water (d) pumping  
pumping water (e) securing heat.
- ( ) 10. The purpose of flowers in a plant is to develop -----  
(a) roots. (b) seeds (c) leaves (d) perfumes (e) branches.
- ( ) 11. The butterfly has ----- of legs. (a) a pair (b) three pairs  
(c) two pairs (d) four pairs (e) five pairs.
- ( ) 12. Electrolysis of water liberates hydrogen and -----  
(a) Chlorine (b) nitrogen (c) Ammonia (d) Oxygen (e) Carbon  
dioxide.
- ( ) 13. The higher fixed point in the centigrade thermometer is  
----- (a) 0 (b) 32 (c) 100 (d) 120 (e) 212
- ( ) 14. When steam is passed over red hot iron ----- is given out.  
(a) Oxygen (b) Nitrogen (c) Hydrogen (d)  $\text{CO}_2$  (e) air.

- ( ) 15. A solid that absorbs ~~moisture~~ moisture from the atmosphere is called a ----- (a) sublime substance (b) anhydrous substance (c) deliquescent substance (d) dry (e) efflorescent.
- ( ) 16. The ~~mixt~~ solution from which crystals grow is called ----- (a) dilute solution (b) distilled water (c) mother liquor (d) royal water (e) strong water.
- ( ) 17. Insoluble impurities from a liquid are removed by ----- (a) Crystallisation (b) sublimation (c) evaporation (d) filtration (e) saturation.
- ( ) 18. The apparatus used to measure the atmosphere pressure is called ----- (a) lactometer (b) thermometer (c) hydrometer (d) ~~lactometer~~ barometer (e) barometer.
- ( ) 19. The plumula grows into ----- (a) cotyledon (b) primary axis (c) flower (d) root system (e) shoot system.
- ( ) 20. When hydrogen is passed over heated copper oxide, copper oxide ~~that~~ becomes copper and hydrogen becomes ----- (a) carbon dioxide (b) hydrogen chloride (c) hydrogen peroxide (d) ammonia (e) water.
- ( ) 21. The lower fixed point of a thermometer is ----- (a) the boiling point of water (b) the melting point of sulphur (c) the melting point of ice (d) the boiling point of milk (e) the melting point of wax.
- ( ) 22. The yellow dust in a flower is ----- (a) chlorophyll (b) ovules (c) protoplasm (d) pollen (e) dirt.
- ( ) 23. The purpose of the roots of plants is to ----- (a) take in
- ( ) 24. The corolla is given off carbon dioxide & take in soil water (d) give off waste matter (e) manufacture of starch.

- ( ) 24. The corolla is made up of ----- (a) manufacture  
of starch (b) stamens (c) ovules (d) pistels  
(e) petals
- ( ) 25. Heat is carried horizontally by ----- (a) conduction  
(b) erosion (c) transpersion (d) convection  
(e) radiation.
- (-----) 26. The spring balance measures ----- (a) Volume  
(b) mass (c) weight (d) ~~area~~ Area of a body (e) density.
- ( ) 27. The microphyle is present in ----- (a) spleen  
(b) lungs (c) root (d) seed (e) flower.
- ( ) 28. Spodium is kept in ----- (a) milk (b) alcohol water  
(c) kerosene oil (d) turpentine
- ( ) 29. Embryp is found inside a ----- (a) root (b) leaf  
(c) branch (d) seed (e) stem.
- ( ) 30. A Liquid differs from a solid in ----- (a) being  
lighter (b) having no definite weight (c) having  
no definite shape (d) moving easily downwards (e)  
----- having no definite size.

### COMPLETION TEST

Instruction:- In the following statements one word is omitted each =  
(dash) indicates the omission of one word; write the missing word in the  
space provided on the left hand side of each statement.

Example:- (Pistel) 1. Ovary is a part of -----

(Expands) 2. When iron is heated it -----

Similarly answer the following:-

- ( ) 1. The lower fixed point of a Fahrenheit thermometer is ----- degrees.
- ( ) 2. The compressibility of a body depends upon its -----.
- ( ) 3. A fall in the mercury level of a barometer indicates a ----- in atmospheric pressure.
- ( ) 4. Melting ice is a ----- change.
- ( ) 5. Square yards is the unit of length in the ----- system.
- ( ) 6. The space left between two railway lines because railway lines during summer.
- ( ) 7. The apparatus used to transfer a small known volume of a liquid from one vessel to the other is called the -----.
- ( ) 8. The tadpole breathes through its -----.
- ( ) 9. Left auricle receives ----- blood.
- ( ) 10. The lungs are the ----- organs in man.
- ( ) 11. The white blood corpuscles are manufactured in the -----.
- ( ) 12. The urinary system is found in the ----- cavity.
- ( ) 13. A soil that yields a good crop is called a ----- soil.
- ( ) 14. Butterfly belongs to a group of animals called -----.
- ( ) 15. The caterpillar feeds up on the ----- of plants.
- ( ) 16. The green colour present in the leaves is called -----.
- ( ) 17. The green colouring matter in a leaves is called -----.

- ( ) 19. The belly of the frog feels ----- rawh. touch
- ( ) 20. The tadpole feeds upon the leaves of ---- plants.
- ( ) 21. Dissolving of sugar in water is an example -----  
of change.
- ( ) 22. Milk becoming curds is -----change.
- ( ) 23. Animal charcoal is used in the -----industry.
- ( ) 24. Hydrogen is collected over water because -----
- ( ) 25. Water is a compound of hydrogen and -----
- ( ) 26. A mixture of iron filing and sand can be  
separated by using a -----

\*\*\*\*\*

### CLASSIFICATION TEST

Instructions:- Of the five items given below in each question, one item does not belong to that group as it does not agree with that group. Find out that item and write it in the space provided on the left hand side.

Example:- (Lung) Eye; Tongue; Nose; Lung ear.

Except lung the other four belong to the group of sensory organs.

Therefore the xx item lung has been written in the brackets.

Similarly answer the following:

- ( ) 1. Ovary stamen. calyx. petals stomata.
- ( ) 2. Nostrils. food pipe. wind pipe. larynx lungs.
- ( ) 3. Ginger turmeric onion lotus onion.
- ( ) 4. Egg. larva. pupa. pupa. adult.
- ( ) 5. Inferior vena cava. superior vena cava. pulmonary artery.

- ) 6. Water milk, mercury soil oil.
- ) 7. Foot in h. centimetre gram metre.
- ) 8. Glass, brass wool, cotton wood.
- ) 9. Steel copper glass diamond chalk.
- ) 10 Glass stone cast iron brick steel.
- ) 11. Water castor oil, milk, wire lime juice.
- ) 12. Oxygen, magnesium Hydrogen, Nitrogen carbon-di-oxide.
- ) 13. Potassium chloride potassium persulphate, red oxide of mercury, lead nitrate potassium chloride.
- ) 14. Gas carbon graphite, soot, wood charcoal bone charcoal.
- ) 15. Ice, butter, sulphur, camphor wax-
- ) 16. Manganese dioxide potassium ~~nitrate~~ chlorate, gun powder, iron sulphide, sodium hydroxide.
- ) 17. Calcium chloride, sodium hydroxide, manganese chloride, ; potassium carbonate sodium carbonate.
- ) 18. Seed, coat, anther, cotyledon plumule, radicle.
- ) 19. Flower, root, leaves, stem, branch.
- ) 20. Carrot, radish, potato sweet potato dahila.
- ) 21. Ink filler, syringe, thermometer cycle pump inflater.
- ) 22. Eyes, heart, nose, ears, tongue.
- ) 23. Punctility, viscosity, malliability, tenacity, rigidity.
- ) 24. Stomach, small viscosity malliability, tenacity, rigidity.
- ) 25. ~~Stem~~ Calyx, epicalyx, pedicel staminal tube bulb.

# ANALOGIES TEST

Instructions:- Of the three items given below in each question there is a some relation between any two. Study the three words carefully and understand to relation ship of the two items. Find a forth which has the same relationship to the other x item. Write it in the space xxx provided in the left hand side.

Examples:- (contract) Heat:- Expands:- Cold:.

There is a relationship between 1 & 2 heat expands bodies similarly cold contracts bodies so the forth item is contracts. It should be written in the margin.

Similarly answer the following:-

Answer

- ( ) 1. Convection: liquids:: conduction:.....
- ( ) 2. Centigrade scale :100:: Fahrenheit .....
- ( ) 3. Thermometer: Temperature:: Barometer.....
- ( ) 4. 1 Centrimeter : 10 millimeter :: 1 foot.....
- ( ) 5. Mass:Grams:Length:.....
- ( ) 6. Madras:30° of barometer high :: Bangalore....
- ( ) 7. Air:Wind pipe:: Food.....
- ( ) 8. Pedicel :flower:: Petal.....
- ( ) 9. Sepals:Calyx:: Petals.....
- ( ) 10.Potato: tuber::onion.....



- ( ) 12. Cattle:Ovary :: Pollen grandur.....
- ( ) 13. Right Ventricle: Pulmonary artery::Left ventricle.....
- ( ) 14. Blood: man: asp:.....
- ( ) 15. Flammable:Radical::Shoot.....
- ( ) 16. Plant: Seed::Bird.....
- ( ) 17.Diamond:Charcoal::Hard:.....
- ( ) 18.Air:Water::Mixture:.....

### MATCHING TEST

**Instruction:-** Two lists of words are given below in "A" one refers to the Scientific terms and the other refers to their values. Similarly there are two lists in "B" and "C" referring to the column match the terms and their values in "A" by writing in bracket on the left hand side of each term the number of its corresponding constants. Similarly write the number of the definite item in "B" and "C" in the bracket on the left hand side of its corresponding scientific terms.

<u>Example:</u>	( ) Substance	Color
	( ) Charcoal	1.White.
	( ) Copper	2.Black.
	( ) Milk	3.Red.

"A"

### Scientific terms:

- ( ) height of mercury in a barometer at a sea level: 1) 212 F
- ( ) melting point of ice: 2) 100 C
- ( ) Higher fixed point of the Fahrenheit thermometer 3) 32°

- ( ) Boiling point of water. 4) 98.6°  
 ( ) Normal temperature of the human body. 5) 98.6°

upn

- ( ) Tricuspid Valve 1. A small opening on one side of seed.  
 ( ) Filament. 2. The upper part of the primary axis.  
 ( ) Style. 3. False legs of the caterpillar.  
 ( ) Scales 4. The tube connecting the ovary and stigma.  
 ( ) Plumule 5. The colored covering on the wings of the butterfly.  
 ( ) Testa 6. The stalk of the stamens.  
 ( ) Microphyle 7. The valve between the L.A. and L.V.  
 ( ) Bi-cuspid valve. 8. The outer part of the seed.  
 ( ) Pseudo-pads. 9. The valve between the E.A. and R.V.

upn

Column I

Column II

- ( ) Density 1. Solid being drawn into thin wires.  
 ( ) Malleability 2. Solids being broken when hammered.  
 ( ) Brittleness 3. Mass per unit volume.  
 ( ) Density 4. Regarding original shape after the next release of pressure.  
 ( ) Sublimation 5. Solids being beaten into thin sheets.  
 ( ) Elasticity 6. One thousand c.c. of a liquid.  
 ( ) Litre. 7. One quantity of heat in a body.

ENUMERATION TEST

**Instructions:-** Answer the following questions by writing the words of the answers in the brackets below each question.

**I. Name two chemicals used in the preparation of Oxygen in the Laboratory.**

1. (                      )    2. (                      )

**II. State two important chemical properties of Oxygen.**

1. (                      )    2. (                      )

**III. Mention any three important uses of oxygen.**

1. (                      )    2. (                      ).

**IV. Give two important uses of hydrogen.**

1. (                      )    2. (                      )

**V. Mention four allotropic forms of carbon.**

1. (                      ) 2. (                      ) 3. (                      ) 4. (                      ).

**VI. Name the three processes involved in the preparation of a mixture of common salt ammonium chloride and sand.**

1. (                      ) 2. (                      ) 3. (                      )

**VII. Name two uses of barometer.**

1. (                      ) 2. (                      ) 3. (                      )

**VIII. Mention two uses of a Brahma press.**

1. (                      )    2. (                      )

**IX. Mention three reasons for using mercury in a barometer.**

1. (                      ) 2. (                      ) 3. (                      )

X. Name the three processes by which heat is transmitted.

1. ( ) 2. ( ) 3. ( )

XI. Mention the two factors we should know to calculate the density of substances.

**16                      ) 26                      )**

**XII** Name the parts of the soil.

1. ( ) 2. ( ) 3. ( ).

## PROBLEM TEST

**Instructions:-** Write the answer for the following questions in the space provided under each question.

1. Why does the weight of a magnesium wire increase when heated in Air?

2.4 What happens when yellow phosphorous is introduced into a jar of oxygen?

3. What kind of chemical change takes place when potassium chlorate is heated?

4. Why does copper sulphate become white when it is heated?

5. Why does water rise into the syringe when the piston is drawn upwards?

6. Why does not air inside a cycle tube come out?

7. A rod of iron held in fire does not burn where as a rod of wood burns why?

( )

8. When salt dissolves in water the level of water does not rise why?

( )

9. Why do we make use of a wire gauge while heating breakers and flashes in the laboratory?

( )

10. Why does the butterfly lay eggs on the undersurface of the leaves.

( )

11. Why does the tank frog come to the surface of water every now and then?

( )

12. Which organ pumps blood to all parts of the body?

( )

13. What do red corpuscles give the living cells?

( )

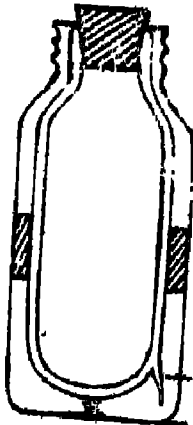
14. A jar of air is inverted over a jar of hydrogen. After some time a burning candle is introduced into the upper jar. what happens? why?

( )

15. The temperature of a body is 122° What would it be in the centigrade scale?

PIAGRAM TEST

\*\*\*



What does figure 1 represents( )

2. Why is "B" silvered on the inside ( )

3. What is the inner bottle made ( )

Figure.1.

PREPARATION OF OXYGEN

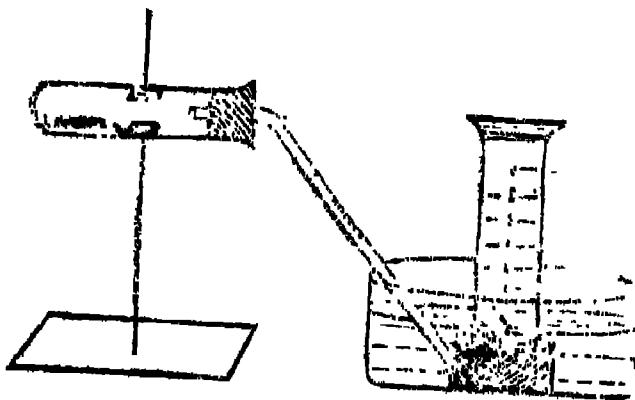


Figure.2.

What is omitted in this figure?( )

2. What substances are put in the test tube?( )

3. Which of the two substances gives off oxygen?( )

4. What is the name given to this method of collection of the gas? )

( )



Figure No. 3.

In the given figure:

1. Name the part marked (1); (2); (3) & (4)

1( ) 2( ) 3( ) 4( )

2. To which part of the body does part 1 carry blood? ( )

3. To which part of the body does part 2 carry blood? ( )

4. What kind of blood does part 2 carry? ( )

5. What kind of blood does the left auricle receive? ( )

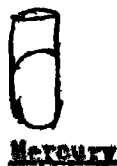
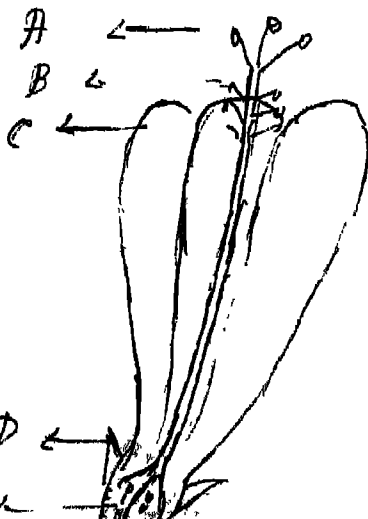


Figure No. 4.

Which of the two given figures is wrong?  
&  
Why?

( )

Figure No. 5.



Name the parts marked

A. ( )  
B. ( )  
C. ( )  
D. ( )  
E. ( )





Appendix c,

**TEACHERS' COLLEGE, MYSORE**  
**Achievement Test in General Science**  
**(For High School II Year)**

---

*Name* .....

*Age* .....

*Boy/Girl* .....

*Optional Subjects* .....

*Mother Tongue* .....

*School* .....

*Occupation of Father or Guardian* .....

*Annual Income of Father or Guardian* .....

---

**INSTRUCTIONS**

1. Fill in the above entries first.
  2. Read carefully the instructions given at the beginning of each test, understand them and then begin to answer.
  3. Answer these questions as quickly as you can.
  4. Do not answer the questions you do not know and those about which you are doubtful.
  5. If you cannot answer any question do not waste time. Pass on to the next question. You may answer the question left out, if there is time.
  6. Do not ask questions after you start answering.
-

## True - False Test

### Instructions :

Some of the following statements are true and some are false. The letters T and F are printed on the left hand side of each statement. Bracket the letter T if the statement is true. Bracket the letter F if the statement is false. Do not mark statements you do not know. Do not guess. Guessing reduces your score.

### Example :

- ( T ) F      1. Sugar dissolves in water.  
T ( F )      2. Petals are green in colour.

Statement (1) is true. Therefore T is bracketted.

Statement (2) is false. Therefore F is bracketted.

Similarly answer the following :

- T F    1. Liquids find their own level in a communicating vessel.  
T F    2. Graphite is an allotropic form of carbon.  
~~T F~~ 3. *The mos flask is used to measure heat-*  
T F    4. A hot glass chimney cracks when a drop of water falls on it.  
T F    5. The wings of a butterfly are covered with scales.  
T F    6. Burning of paper is a physical change.  
T F    7. Atmospheric pressure depends upon the height of a place above sea level.  
T F    8. Iodine melts when heated.  
T F    9. Hydrogen is heavier than air.  
T F    10. A body weighs more at the poles than at the equator.  
T F    11. Hydrogen is a supporter of combustion.  
T F    12. The part of air that supports life is nitrogen.  
T F    13. Buds are found between primary and secondary roots.  
T F    14. A mixture of common salt and sand can be separated by sublimation.  
T F    15. Sodium is kept in water.  
T F    16. Movements of the body are caused by muscles.  
T F    17. White corpuscles are irregular in shape.  
T F    18. Manganese dioxide is a catalytic agent.  
T F    19. Calipers is used to measure the diameter of a cylinder.  
T F    20. Right auricle receives pure blood.

## Modified Form of True - False Test

### Instructions :

Some of the following statements are true and some are false. The letters T and F are printed on the left hand side of each statement. If the statement is true bracket the letter T. If the statement is false bracket the letter F. In each statement one word is underlined. It is this word that makes the statement *true or false*. If a statement is false it can be made true by replacing the underlined word. Think of such a word and write it in the brackets provided on the left hand side of the statement.

### Examples :

(T) F (            ) 1. The unit of mass in the British system is Pound.

T F ( porous ) 2. Sponge absorbs water freely because it is elastic.

The first statement is true and so T is bracketted. There is no need to change the underlined word. The second statement is false. Sponge absorbs water because it is porous. Hence the word porous is written in the brackets.

Similarly answer the following :

T F (            ) 1. Air is a mixture.

T F (            ) 2. Hydrogen is a non-combustible gas.

T F (            ) 3. In a chemical change one or more new substances are formed.

T F (            ) 4. Priestley discovered oxygen.

T F (            ) 5. The melting point of ice on the Fahrenheit scale is 32°.

T F (            ) 6. The presence of earthworm in the soil is harmful to plants.

T F (            ) 7. The mass of a body is measured by a thermometer.

T F (            ) 8. Sodium carbonate is deliquescent.

T F (            ) 9. Frog belongs to the group of vertebrates.

T F (            ) 10. The unit of mass in the Metric system is ounce.

## Multiple Choice Test

### Instructions :

Here are some incomplete statements. They can be completed by only one of the five answers given. Select the correct answer and write its number in the brackets provided on the left hand side of each statement.

### Examples :

( 2 ) I. Stigma is a part of —

1. stomata,    2. pistil,    3. leaf,    4. stamen,    5. fruit.

( 3 ) II. When red oxide of mercury is heated it gives off —

1. hydrogen,    2. nitrogen,    3. oxygen,    4. water vapour,  
5. carbon dioxide.

In example I pistil is the correct word. So (2) is written in brackets. In example II oxygen is the correct word. Hence (3) is written in the brackets.

Similarly answer the following :

(   ) I. A thermometer is used to measure —

1. weight,    2. height,    3. temperature,    4. volume,  
5. pressure.

(   ) II. Distillation is a method of —

1. pumping water,    2. transmitting heat,    3. exerting pressure,  
4. purifying water,    5. measuring heat.

(   ) III. The radicle is present in —

1. spleen,    2. lungs,    3. root,    4. flower,  
5. seed.

(   ) IV. Spring balance is used to measure —

1. volume,    2. weight,    3. area,    4. pressure,  
5. mass.

(   ) V. The butterfly has — pairs of legs :

1. two pairs,    2. three pairs,    3. four pairs.  
4. five pairs,    5. six pairs.

(   ) VI. Insoluble impurities in water are removed by —

1. crystallisation,    2. sublimation,    3. evaporation,  
4. filtration,    5. distillation.

- ( ) VII. The lower fixed point of a thermometer is —
1. the melting point of wax.
  2. the melting point of butter.
  3. the melting point of sulphur.
  4. the melting point of ice.
  5. the melting point of phosphorus.
- ( ) VIII. When steam is passed over red hot iron — is given out.
1. oxygen,
  2. nitrogen,
  3. carbon dioxide,
  4. hydrogen,
  5. sulphur dioxide.
- ( ) IX. Combustion is another name for —
1. drying,
  2. heating,
  3. boiling,
  4. burning,
  5. melting.
- ( ) X. Heat is transmitted in solids by —
1. convection,
  2. evaporation,
  3. radiation,
  4. sublimation,
  5. conduction.

### Matching Test

#### Instructions :

Here are two columns of items. Each item in column A is related to some item in B. Find out the related item and write the serial number of that item in the space provided on the left hand side.

#### Example :

A	B
( 2 ) Charcoal	1. White
( 3 ) Copper	2. Black
( 1 ) Milk	3. Red
	4. Yellow

Similarly answer the following :

A	B
( ) Litre.	1. 212°F
( ) Melting point of ice.	2. 76 inches.
( ) Higher fixed point of a Fahrenheit thermometer.	3. 30 inches.
( ) Height of a mercury baro- meter at sea-level.	4. 98.4°F

- |   |  |
|---|--|
| ( ) Normal temperature of the human body. | 5. $0^{\circ}\text{C}$   |
| ( ) Tricuspid valve.                      | 6. 1000 c.c.   |
| ( ) Filament.                             | 7. Solids being beaten into thin sheets.                       |
| ( ) Malleability.                         | 8. Mass per unit volume.                                       |
| ( ) Density.                              | 9. The door between the right auricle and the right ventricle. |
| ( ) Sublimation.                          | 10. Solid directly becoming a gas when heated.                 |
|   | 11. Stalk of stamen.   |
|   | 12. Quantity of heat in a body.                                |

### Completion Test

#### Instructions :

In each of the following statements one word is omitted which is indicated by a — (dash). Write the missing word in the brackets on the left hand side of each statement.

#### Examples :

- (pistil) 1. Ovary is a part of — .  
 (expands) 2. When iron is heated it — .

Similarly answer the following :

- ( ) 1. The lower fixed point of a Fahrenheit thermometer is — degree.  
 ( ) 2. The caterpillar feeds upon the — of plants.  
 ( ) 3. The green colouring matter in a leaf is called — .  
 ( ) 4. Rusting of iron is an example of a — change.  
 ( ) 5. Yard is the unit of length in the — system.  
 ( ) 6. The left auricle receives — blood.  
 ( ) 7. Melting of ice is a — change.  
 ( ) 8. — is called Nature's ploughman.  
 ( ) 9. Butterfly sucks its food with the help of — .  
 ( ) 10. A mixture of iron filings and sulphur can be separated by — using a — .

## Classification Test

### Instructions :

Of the items given below in each question one item does not belong to that group. Find out that item and write it in the brackets on the left hand side.

### Examples :

- (Lung) 1. Eye, tongue, nose, lung, ear.  
 (Viscosity) 2. Viscosity, rigidity, ductility, malleability, tenacity.

In example No. 1, except lung the other four are sensory organs. Therefore the word lung has been written in the brackets. In example 2, except viscosity the other four are properties of solids. So viscosity is written in the brackets.

Similarly answer the following :

- ( ) 1. Ovary, stamen, calyx, petal, stomata.  
 ( ) 2. Water, milk, mercury, soil, oil.  
 ( ) 3. Oxygen, carbon, sodium, magnesium, carbon dioxide.  
 ( ) 4. Foot, inch, centimetre, gram, metre.  
 ( ) 5. Flower, leaves, root, stem, branch.  
 ( ) 6. Ink-filler, syringe, thermometer, cycle pump, foot-ball inflator.  
 ( ) 7. Seed coat, anther, cotyledon, plumule, radicle.  
 ( ) 8. Onion, flower, radish, cabbage, ginger.  
 ( ) 9. Manganese dioxide, gun-power, iron sulphide, potassium chlorate, sodium hydroxide.  
 ( ) 10. Liver, right auricle, right ventricle, left auricle, left ventricle.

## Analogies Test

### Instructions :

Of the three items given in each question, there is some relation between the first two. Understand the relationship of the first two items and find the fourth item which has the same relationship with the third and write it in the brackets on the left hand side.

### Examples :

- (Contracts) 1. Heat : Expands :: Cold : .....  
 (Liquid) 2. Oxygen : Gas :: Water : .....

Heat expands bodies, similarly cold contracts bodies. Hence the word contracts is written in the brackets. In the second example oxygen is a gas, water is a liquid. So liquid is written in the brackets.

Similarly answer the following :

- |   |   |     |                     |   |                |    |                     |   |       |
|---|---|-----|---------------------|---|----------------|----|---------------------|---|-------|
| ( | ) | 1.  | Convection          | : | liquids        | :: | Conduction          | : | ..... |
| ( | ) | 2.  | Centigrade<br>scale | : | 100            | :: | Fahrenheit<br>scale | : | ..... |
| ( | ) | 3.  | Barometer           | : | Pressure       | :: | Thermometer         | : | ..... |
| ( | ) | 4.  | 1 Centimetre        | : | 10 Millimetres | :: | 1 Foot              | : | ..... |
| ( | ) | 5.  | Air                 | : | Wind pipe      | :: | Food                | : | ..... |
| ( | ) | 6.  | Plumule             | : | Shoot          | :: | Radicle             | : | ..... |
| ( | ) | 7.  | Potato              | : | Tuber          | :: | Onion               | : | ..... |
| ( | ) | 8.  | Diamond             | : | Hard           | :: | Graphite            | : | ..... |
| ( | ) | 9.  | Plant               | : | Seed           | :: | Bird                | : | ..... |
| ( | ) | 10. | Air                 | : | Mixture        | :: | Water               | : | ..... |

## Enumeration Test

**Instructions :**

**Answer the following questions in the space provided below each question.**

### Examples :

1. Name the three main parts of the human body :
  1. Head,
  2. Trunk,
  3. Limbs.
2. Name the two elements contained in water :
  1. Oxygen,
  2. Hydrogen.

**Answer the following similarly :**

1. Name two chemicals used in the laboratory to prepare hydrogen :  
1.  
2.

2. Name two important uses of oxygen :

- |    |    |    |    |    |    |    |    |    |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |      |
|----|----|----|----|----|----|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. | 26. | 27. | 28. | 29. | 30. | 31. | 32. | 33. | 34. | 35. | 36. | 37. | 38. | 39. | 40. | 41. | 42. | 43. | 44. | 45. | 46. | 47. | 48. | 49. | 50. | 51. | 52. | 53. | 54. | 55. | 56. | 57. | 58. | 59. | 60. | 61. | 62. | 63. | 64. | 65. | 66. | 67. | 68. | 69. | 70. | 71. | 72. | 73. | 74. | 75. | 76. | 77. | 78. | 79. | 80. | 81. | 82. | 83. | 84. | 85. | 86. | 87. | 88. | 89. | 90. | 91. | 92. | 93. | 94. | 95. | 96. | 97. | 98. | 99. | 100. |
| 1. | 2. | 3. | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. | 16. | 17. | 18. | 19. | 20. | 21. | 22. | 23. | 24. | 25. | 26. | 27. | 28. | 29. | 30. | 31. | 32. | 33. | 34. | 35. | 36. | 37. | 38. | 39. | 40. | 41. | 42. | 43. | 44. | 45. | 46. | 47. | 48. | 49. | 50. | 51. | 52. | 53. | 54. | 55. | 56. | 57. | 58. | 59. | 60. | 61. | 62. | 63. | 64. | 65. | 66. | 67. | 68. | 69. | 70. | 71. | 72. | 73. | 74. | 75. | 76. | 77. | 78. | 79. | 80. | 81. | 82. | 83. | 84. | 85. | 86. | 87. | 88. | 89. | 90. | 91. | 92. | 93. | 94. | 95. | 96. | 97. | 98. | 99. | 100. |



3. Name three allotropic forms of carbon :

- 1.
- 2.
- 3.

4. Mention two uses of a barometer :

- 1.
- 2.

5. Mention two uses of a Bramah Press :

- 1.
- 2.

6. Name three processes by which heat is transmitted :

- 1.
- 2.
- 3.

7. State three reasons for using mercury in the barometer :

- 1.
- 2.
- 3.

8. Name the three constituents of the soil :

- 1.
- 2.
- 3.

## Diagrams Test

### I.

1. What does this figure represent ?

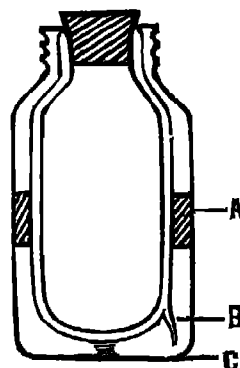
.....

2. Name the parts marked :

A.....

B.....

C.....



### II. Preparation of oxygen in the laboratory :

1. What is omitted in this figure ?

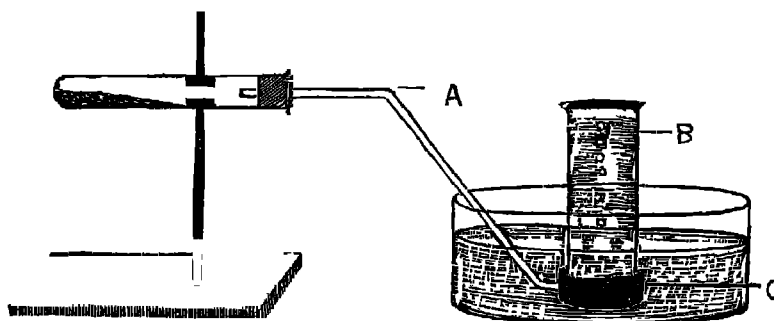
.....

2. Name the parts marked :

A.....

B.....

C.....



3. Name the two substances put in the test-tube :

(i) .....

(ii) .....

4. Which of these two substances gives off oxygen ?

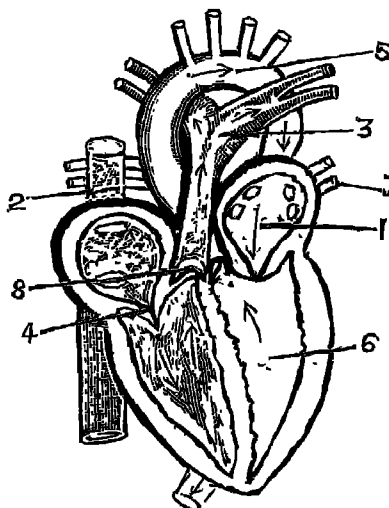
.....

5. In this case oxygen is collected by the.....displacement of water.

### III. Longitudinal section of the Human heart :

In this sketch some important parts are numbered. Their names are written below. Find the number corresponding to each part and write it in the brackets provided :

Aorta	....	(     )
Left auricle	....	(     )
Tricuspid valve	....	(     )
Pulmonary artery	....	(     )
Semilunar valve	....	(     )
Superior vena cava	....	(     )
Pulmonary vein	....	(     )
Left ventricle	....	(     )



## ಸರಿ - ತಪ್ಪು ಪರೀಕ್ಷೆ

ಸೂಚನೆ—ಈ ಕೆಳಗಿನ ಹೇಳಿಕೆಗಳಲ್ಲಿ ಕೆಲವು ಸರಿ, ಕೆಲವು ತಪ್ಪು. ಪ್ರತಿ ಹೇಳಿಕೆಯ ಎಡ ಭಾಗದಲ್ಲಿ, T ಮತ್ತು F ಎಂಬ ಎರಡು ಅಕ್ಷರಗಳನ್ನು ಮುದ್ರಿಸಲಾಗಿದೆ. ಹೇಳಿಕೆಯು ಸರಿಯಾಗಿದ್ದರೆ T ಎಂಬ ಅಕ್ಷರವನ್ನೂ, ತಪ್ಪಾಗಿದ್ದರೆ F ಎಂಬ ಅಕ್ಷರವನ್ನೂ ಅವರಣ(Bracket)ದಲ್ಲಿ ಸೇರಿಸಿ. ತಿಳಿಯದೆ ಇದ್ದ ಹೇಳಿಕೆಗಳನ್ನು ಗುರ್ತಿಸದೆ ಬಿಟ್ಟುಬಿಡಿ. ಊಹಿಸಿ ಗುರ್ತಿಸುವುದರಿಂದ ಅಂಕಗಳು ಕಡಿಮೆಯಾಗುತ್ತವೆ.

**ಉದಾಹರಣೆ :**

(T) F 1. ಸಕ್ಕರೆಯು ನೀರಿನಲ್ಲಿ ಕರಗುತ್ತದೆ.

T (F) 2. ದಳಗಳು ಬಣ್ಣದಲ್ಲಿ ಹೆಸುರಾಗಿರುತ್ತವೆ.

ಮೊದಲಿನ ಹೇಳಿಕೆಯು ಸರಿ. ಆದ್ದರಿಂದ T ಎಂಬ ಅಕ್ಷರಕ್ಕೆ ಅವರಣವನ್ನು ಹಾಕಿದೆ. ಎರಡನೆಯ ಹೇಳಿಕೆಯು ತಪ್ಪು. ಆದ್ದರಿಂದ F ಎಂಬ ಅಕ್ಷರಕ್ಕೆ ಅವರಣವನ್ನು ಹಾಕಿದೆ.

ಇದೇ ರೀತಿಯಲ್ಲಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

- T F 1. ದ್ರವವಸ್ತುಗಳು ತಮ್ಮ ಮಟ್ಟವನ್ನು ತಾವೇ ಹುಡುಕಿಕೊಳ್ಳುತ್ತವೆ.
- T F 2. ಗ್ರಾಫೈಟ್, ಇಂಗಾಲದ ಒಂದು ಬಹುರೂಪ.
- T F 3. ಶಾಖವನ್ನು ಅಳಿಯಲು ಥರ್ಮೋಫ್ಲಾಸ್ಕ್ ಉಪಯೋಗಿಸುತ್ತಾರೆ.
- T F 4. ಬಿಸಿ ಗಾಜಿನ ಚಮಚಿಯ ಮೇಲೆ ನೀರಿನ ತೊಟ್ಟು ಬಿದ್ದರೆ ಅದು ಒಡೆದುಹೋಗುತ್ತದೆ.
- T F 5. ಚಿಟ್ಟೆಯ ರೆಕ್ಕೆಯ ಮೇಲೆಲ್ಲಾ ಹುರುನೆಗಳಿರುವವು.
- T F 6. ಕಾಗದವು ಉರಿದಾಗ ಭೌತ ಬದಲಾವಣೆಯು ನಡೆಯುತ್ತದೆ.
- T F 7. ಸಮುದ್ರಮಟ್ಟದಿಂದ ಇರುವ ಎತ್ತರಕ್ಕೆ ಅನುಗುಣವಾಗಿ ಒಂದು ಸ್ಥಳದ ವಾಯುಸಂಮರ್ಧವು ಇರುತ್ತದೆ.
- T F 8. ಕಾಯಿಸಿದಾಗ ಅಯೋಡಿನ್ ಕರಗುತ್ತದೆ.
- T F 9. ಜಲಜನಕವು ಗಾಳಿಗಿಂತ ಭಾರ.
- T F 10. ಒಂದು ವಸ್ತುವಿನ ತೂಕವು ಭೂಮಧ್ಯರೇಖೆಯ ಬಳಿ ಇರುವುದಕ್ಕಿಂತ ಧ್ರುವಗಳ ಬಳಿ ಅಧಿಕ.
- T F 11. ಜಲಜನಕವು ದಹನಾನುಕೂಲಿ.
- T F 12. ಗಾಳಿಯ ಜೀವನಾಧಾರವಾದ ಭಾಗವು ಸಾರಜನಕ.
- T F 13. ತಾಯಿಬೇರು ಮತ್ತು ಕವಲುಬೇರುಗಳ ನಡುವೆ ಮೊಗ್ಗುಗಳು ಇರುತ್ತವೆ.
- T F 14. ಉತ್ಪತ್ತಿನ ಕ್ರಮದಿಂದ ಮರಳು ಮತ್ತು ಅಡಿಗೆ ಉಪ್ಪುಗಳ ಮಿಶ್ರಣವನ್ನು ಬೇರ್ಪಡಿಸಬಹುದು.
- T F 15. ಸೋಡಿಯಂ ಅನ್ನು ನೀರಿನಲ್ಲಿ ಇಡುತ್ತಾರೆ.
- T F 16. ದೇಹದ ಚಲನೆಗಳು ಮಾಂಸಖಂಡಗಳಿಂದ ನಡೆಯುತ್ತವೆ.
- T F 17. ಬಿಳಿಯ ರಕ್ತಕಣಗಳಿಗೆ ಅನಿರ್ದಿಷ್ಟ ಆಕಾರವಿರುತ್ತದೆ.
- T F 18. ಮ್ಯಾಂಗನೀಸ್ ಡೈ ಆಕ್ಸೈಡ್ ಒಂದು ವೇಗವರ್ಧಿ.
- T F 19. ಜಾರುವ ಕ್ಯಾಲಿಪರ್ಸ್‌ನ್ನು ತಿಲಿಂದರದ ವ್ಯಾಸವನ್ನಳೆಯಲು ಉಪಯೋಗಿಸುತ್ತಾರೆ.
- T F 20. ಬಲಹೃತ್ಪರ್ಣಕ್ಕೆ ಶುದ್ಧ ರಕ್ತವು ಬರುತ್ತದೆ.

### ರೂಪಾಂತರಗೊಳಿಸಿದ ಸರಿ - ತಪ್ಪು ಪರೀಕ್ಷೆ

**ಸೂಚನೆ**—ಈ ಕೆಳಗಿನ ಕೆಲವು ಹೇಳಿಕೆಗಳು ಸರಿ, ಕೆಲವು ತಪ್ಪು. ಪ್ರತಿ ಹೇಳಿಕೆಯ ಎಡದಲ್ಲಿ T ಮತ್ತು F ಎಂಬ ಅಕ್ಷರಗಳನ್ನು ಮುದ್ರಿಸಲಾಗಿದೆ. ಹೇಳಿಕೆಯು ಸರಿಯಾಗಿದ್ದರೆ T ಎಂಬ ಅಕ್ಷರಕ್ಕೆ ಅವರಣವನ್ನು ಹಾಕಿರಿ. ತಪ್ಪಾಗಿದ್ದರೆ F ಎಂಬ ಅಕ್ಷರಕ್ಕೆ ಅವರಣವನ್ನು ಗುರುತಿಸಿ. ಪ್ರತಿ ಹೇಳಿಕೆಯಲ್ಲಿಯೂ ಒಂದು ಪದದ ಕೆಳಗಡೆ ಗೆರೆಯನ್ನು ಎಳೆದಿದೆ. ಈ ಪದವೇ ಪ್ರತಿಹೇಳಿಕೆಯನ್ನೂ ಸರಿ ಅಥವಾ ತಪ್ಪುಗುವಂತೆ ಮಾಡುತ್ತದೆ. ಹೇಳಿಕೆಯು ತಪ್ಪಾಗಿದ್ದರೆ ಹೀಗೆ ಗೆರೆ ಎಳೆದಿರುವ ಪದದ ಬದಲು ಬೇರೊಂದು ಪದವನ್ನು ಬರೆದು ಹೇಳಿಕೆಯನ್ನು ಸರಿಪಡಿಸಬಹುದು.

#### ಉದಾಹರಣೆ :

- ( T ) F (                      ) 1. ಬ್ರಿಟಿಷ್ ಪದ್ಧತಿಯಲ್ಲಿ ವಸ್ತುರಾಶಿಯ ಮೂಲಮಾನವು ಪೌಂಡ್.
- T ( F ) ( ಸಚ್ಚಿದ್ರತೆ ) 2. ಸ್ಪಂಜಿಗೆ ಸ್ಥಿತಿಸ್ಥಾಪಕ ಶಕ್ತಿ ಇರುವುದರಿಂದ ಅದು ನೀರನ್ನು ಹೀರಿಕೊಳ್ಳುತ್ತದೆ.

ಮೊದಲಿನ ಹೇಳಿಕೆಯು ಸರಿ. ಆದುದರಿಂದ T ಎಂಬ ಅಕ್ಷರಕ್ಕೆ ಅವರಣವನ್ನು ಎಳೆದಿದೆ. ಎರಡನೆಯದು ತಪ್ಪು. ಸ್ಪಂಜಿಗೆ ಸಚ್ಚಿದ್ರತೆ ಇರುವುದರಿಂದ ಅದು ನೀರನ್ನು ಹೀರಿಕೊಳ್ಳುತ್ತದೆ. ಆದ್ದರಿಂದ ಅವರಣದಲ್ಲಿ ಸಚ್ಚಿದ್ರತೆ ಎಂಬ ಪದವನ್ನು ಬರೆಯಲಾಗಿದೆ.

#### ಇದೇ ರೀತಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

- T F (                      ) 1. ಗಾಳಿಯು ಒಂದು ಮಿಶ್ರಣ.
- T F (                      ) 2. ಜಲಜನಕವು ದಹ್ಯವಸ್ತುವಲ್ಲ.
- T F (                      ) 3. ರಸಾಯನಿಕ ಬದಲಾವಣೆಯಲ್ಲಿ ಒಂದು ಅಥವಾ ಹೆಚ್ಚು ಹೊಸ ವಸ್ತುಗಳು ಉತ್ಪತ್ತಿಯಾಗುತ್ತವೆ.
- T F (                      ) 4. ಜೋಸಫ್ ಪ್ರೀಸ್ಟ್ಲಿಯು ಆಮ್ಲಜನಕವನ್ನು ಕಂಡುಹಿಡಿದನು.
- T F (                      ) 5. ಫಾರಿನ್‌ಹೀಟ್ ಕ್ರಮದಲ್ಲಿ ಮಂಜುಗಡ್ಡೆಯ ಕರಗುವ ಬಿಂದುವು 32°.
- T F (                      ) 6. ಮಣ್ಣಿನಲ್ಲಿ ಎರಿಹುಳುಗಳ ಇರುವಿಕೆಯು ಸಸ್ಯಗಳಿಗೆ ಅಪಾಯಕಾರಿ.
- T F (                      ) 7. ಒಂದು ವಸ್ತುವಿನ ದ್ರವ್ಯರಾಶಿಯನ್ನು ಉಷ್ಣಮಾಪಿಯಿಂದ ಅಳೆಯುತ್ತಾರೆ.
- T F (                      ) 8. ಸೋಡಿಯಂ ಕಾರ್ಬೊನೇಟ್ ಜಲಾಕರ್ಷಕ ವಸ್ತು.
- T F (                      ) 9. ಕಪ್ಪೆಯು ಕಶೇರುಕ ವರ್ಗಕ್ಕೆ ಸೇರಿದ ಪ್ರಾಣಿ.
- T F (                      ) 10. ಮೆಟ್ರಿಕ್ ಪದ್ಧತಿಯಲ್ಲಿ ವಸ್ತುರಾಶಿಯ ಮೂಲಮಾನವು ಕೆಲೋಗ್ರಾಂ.

## ಬಹುಶಃಗಳಿಂದ ಆಯ್ಕೆಯ ಪರೀಕ್ಷೆ

**ಸೂಚನೆ**—ಇಲ್ಲಿ ಕೆಲವು ಅಪೂರ್ಣ ಹೇಳಿಕೆಗಳನ್ನು ಕೊಟ್ಟಿದೆ. ಕೊಟ್ಟಿರುವ ಐದು ಉತ್ತರಗಳಲ್ಲಿ ಒಂದೇ ಒಂದರಿಂದ ಹೇಳಿಕೆಯನ್ನು ಪೂರ್ಣಗೊಳಿಸಬಹುದು. ಸರಿಯುತ್ವವನ್ನು ಚುನಾಯಿಸಿ ಮತ್ತು ಅದರ ಸಂಖ್ಯೆಯನ್ನು ಪ್ರತಿ ಹೇಳಿಕೆಯ ಎಡಗಡೆ ಕೊಟ್ಟಿರುವ ಅವರಣದಲ್ಲಿ ಬರೆಯಿರಿ.

**ಉದಾಹರಣೆಗಳು :**

- ( 2 ) I. ಶಲಾಕಾಗ್ರವು ಇದರ ಒಂದು ಭಾಗವಾಗಿದೆ.  
 (1) ಪತ್ರರಂಧ್ರ, (2) ಶಲಾಕ, (3) ಎಲೆ, (4) ಪರಾಗ,  
 (5) ಹಣ್ಣು.
- ( 3 ) II. ಕೆಂಪು ಪಾದರಸದ ಆಕ್ಷೈಡನ್ನು ಕಾಯಿಸಿದಾಗ ಈ ಅನಿಲವು ಬಿಡುಗಡೆಯಾಗುತ್ತದೆ.  
 (1) ಜಲಜನಕ, (2) ಸಾರಜನಕ, (3) ಆಮ್ಲಜನಕ, (4) ನೀರಾವಿ,  
 (5) ಇಂಗಾಲದ ಡೈ ಆಕ್ಸೈಡ್.

ಮೇಲಿನ ಮೊದಲಿನ ಉದಾಹರಣೆಯಲ್ಲಿ ಶಲಾಕ ಎಂಬುದು ಸರಿಯುತ್ವ. ಆದ್ದರಿಂದ ಅವರಣದಲ್ಲಿ 2 ಎಂದು ಗುರುತಿಸಿದೆ. ಎರಡನೆಯ ಉದಾಹರಣೆಯಲ್ಲಿ ಆಮ್ಲಜನಕ ಎಂಬುದು ಸರಿಯುತ್ವ. ಆದ್ದರಿಂದ ಅವರಣದಲ್ಲಿ 3 ಎಂದು ಗುರುತಿಸಿದೆ.

ಇದೇ ರೀತಿಯಲ್ಲಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

- ( ) I. — ನ್ನು ಅಳೆಯಲು ಉಷ್ಣಮಾಪಿಯನ್ನು ಉಪಯೋಗಿಸುತ್ತಾರೆ.  
 (1) ತೂಕ, (2) ಎತ್ತರ, (3) ಉಷ್ಣತೆ, (4) ಗಾತ್ರ,  
 (5) ಒತ್ತಡ.
- ( ) II. ಭಟ್ಟಿ ಇಳಿಸುವಿಕೆಯು ಇಂತಹ ಒಂದು ವಿಧಾನ :  
 (1) ನೀರನ್ನು ಎತ್ತುವುದು, (2) ಶಾಖಪ್ರಸಾರ, (3) ಸಂಮರ್ದವನ್ನು  
 ಪಡೆಯುವುದು, (4) ನೀರನ್ನು ಶುದ್ಧಗೊಳಿಸುವುದು, (5) ಶಾಖವನ್ನು  
 ಅಳೆಯುವುದು.
- ( ) III. ಪ್ರಥಮ ಮೂಲವು — ಇದರಲ್ಲಿದೆ.  
 (1) ಗುಲ್ಮ, (2) ಶ್ವಾಸಕೋಶ, (3) ಬೇರು, (4) ಹೂವು,  
 (5) ಬೀಜ.
- ( ) IV. — ನ್ನು ಅಳತೆಮಾಡಲು ಸ್ಟ್ರಿಂಗ್ ತ್ರಾಸನ್ನು ಪಯೋಗಿಸುತ್ತಾರೆ.  
 (1) ಗಾತ್ರ, (2) ತೂಕ, (3) ವಿಸ್ತೀರ್ಣ, (4) ಸಂಮರ್ದ,  
 (5) ವಸ್ತುರಾಶಿ.
- ( ) V. ಚಿಟ್ಟಿಗೆ — ಜೊತೆ ಕಾಲುಗಳಿವೆ.  
 (1) ಎರಡು, (2) ಮೂರು, (3) ನಾಲ್ಕು, (4) ಐದು,  
 (5) ಆರು.
- ( ) VI. ದ್ರವದಲ್ಲಿನ ಕರಗದ ಕಶ್ಮಲ ವಸ್ತುಗಳನ್ನು — ಈ ಕ್ರಮದಿಂದ ಬೇರ್ಪಡಿಸುತ್ತೇವೆ.  
 (1) ಹರಳು ಮಾಡುವಿಕೆ, (2) ಉತ್ಪತನ, (3) ಇಂಗಿಸುವಿಕೆ,  
 (4) ಶೋಧಿಸುವಿಕೆ, (5) ಭಟ್ಟಿ ಇಳಿಸುವಿಕೆ.

- ( ) VII. ಉಷ್ಣ ಮಾಪಿಯ ಕೆಳಗಿನ ಆದರ್ಶಬಿಂದುವು——  
 (1) ಮೇಣದ ಕರಗುವ ಬಿಂದು, (2) ಬೆಣ್ಣೆಯ ಕರಗುವ ಬಿಂದು,  
 (3) ಗಂಧಕದ ಕರಗುವ ಬಿಂದು, (4) ಮಂಜುಗಡ್ಡೆಯ ಕರಗುವ ಬಿಂದು,  
 (5) ರಂಜಕದ ಕರಗುವ ಬಿಂದು.
- ( ) VIII. ಕೆಂಪಗೆ ಕಾಯಿಸಿದ ಕಬ್ಬಿಣದ ಮೇಲೆ ನೀರಾವಿಯನ್ನು ಹಾಯಿಸಿದಾಗ——ಉತ್ಪತ್ತಿ ಆಗುತ್ತದೆ.  
 (1) ಆಮ್ಲಜನಕ, (2) ಸಾರಜನಕ, (3) ಇಂಗಾಲದ ಡೈ ಆಕ್ಸೈಡ್,  
 (4) ಜಲಜನಕ, (5) ಗಂಧಕದ ಡೈ ಆಕ್ಸೈಡ್.
- ( ) IX. —ಇದಕ್ಕೆ ಮತ್ತೊಂದು ಹೆಸರು ದಹನ ಎಂದು.  
 (1) ಒಣಗುವಿಕೆ, (2) ಕಾಯಿಸುವಿಕೆ, (3) ಕುದಿಯುವಿಕೆ,  
 (4) ಉರಿಯುವಿಕೆ, (5) ಕರಗುವಿಕೆ.
- ( ) X. ಘನವಸ್ತುಗಳಲ್ಲಿ——ಕ್ರಮದಿಂದ ಶಾಖಪ್ರಸಾರವಾಗುತ್ತದೆ.  
 (1) ಉಷ್ಣನಯನ, (2) ಆವಿಯಾಗುವಿಕೆ, (3) ರಕ್ಷಿಪ್ರಸಾರ,  
 (4) ಉತ್ಪತನ, (5) ಉಷ್ಣವಹನ.

### ಜೋಡಣೆಯ ಪರೀಕ್ಷೆ

ಸೂಚನೆ—ಇಲ್ಲಿ ಕೊಟ್ಟಿರುವ A ಪಟ್ಟಿಯಲ್ಲಿನ ಪ್ರತಿಯೊಂದು ಅಂಶವೂ B ಪಟ್ಟಿಯಲ್ಲಿನ ಒಂದು ಅಂಶಕ್ಕೆ ಸಂಬಂಧ ಹೊಂದಿದೆ. ಅಂತಹ ಅಂಶವನ್ನು ಕಂಡುಹಿಡಿದು, ಅದರ ಸಂಖ್ಯೆಯನ್ನು ಎಡಗಡೆ-ಕೊಟ್ಟಿರುವ ಸ್ಥಳದಲ್ಲಿ ಬರೆಯಿರಿ.

ಉದಾಹರಣೆ :

	A ಪಟ್ಟಿ	B ಪಟ್ಟಿ
( 2 )	ಇದ್ದಿಲು	1. ಬಿಳುಪು
( 3 )	ತಾಮ್ರ	2. ಕಪ್ಪು
( 1 )	ಹಾಲು	3. ಕೆಂಪು
		4. ಹಳದಿ

ಇದೇ ರೀತಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

	A ಪಟ್ಟಿ	B ಪಟ್ಟಿ
( )	ಲೀಟರ್	1. 212°F
( )	ಮಂಜುಗಡ್ಡೆಯ ಕರಗುವ ಬಿಂದು	2. 76 ಅಂಗುಲಗಳು
( )	ಫಾರಿನ್‌ಹೀಟ್ ಉಷ್ಣ ಮಾಪಿಯ ಮೇಲಿನ ಆದರ್ಶಬಿಂದು	3. 30 ಅಂಗುಲಗಳು
( )	ಸಮುದ್ರಮಟ್ಟದಲ್ಲಿ ವಾಯುಭಾರಮಾಪಿಯಲ್ಲಿನ ಪಾದರಸದ ಮಟ್ಟ	4. 0°C
( )	ಮಾನವ ಶರೀರದ ನಾರ್ಮಲ್ ಉಷ್ಣತೆ	5. ವಸ್ತುವಿನ ಶಾಖದ ಮೊತ್ತ.
( )	ಟ್ರೈಕನಾಪಿಡ್ ಕವಾಟಿ	6. 1000 ಘನ ಸೆಂಟಿಮೀಟರ್
( )		7. ಘನವಸ್ತುಗಳನ್ನು ತೆಳುವಾದ ತಗಡುಗಳಾಗಿ ಬಡಿಯುವುದು.
( )	ಪರಾಗ ದಂಡ	8. ಮೂಲಮಾನ ಗಾತ್ರದಲ್ಲಿನ ವಸ್ತುರಾಶಿ
( )	ಪತ್ರರೂಪಕ್ಷಮತ್ವ	9. ಬಲ ಹೈಡ್ರೋಜನ್, ಹೈಡ್ರೋಕ್ಸಿಜನ್ ನಡುವಿನ ಕವಾಟಿ
( )	ಸಾಂದ್ರತೆ	10. ಘನವಸ್ತುಗಳನ್ನು ಕಾಯಿಸಿದಾಗ ನೇರವಾಗಿ ಆವಿಯ ರೂಪಕ್ಕೆ ಬರುವಿಕೆ.
( )	ಉತ್ಪತನ	11. ಕೇಸರದ ತೊಟ್ಟು
		12. 98.4°F

### ಪೂರಕ ಪರೀಕ್ಷೆ

ಸೂಚನೆ—ಈ ಕೆಳಗಿನ ಪ್ರತಿ ಹೇಳಿಕೆಯಲ್ಲಿಯೂ ಒಂದು ಪದ ಬಿಟ್ಟುಹೋಗಿದೆ. ಇದನ್ನು ಒಂದು ಗೆರೆಯಿಂದ ಸೂಚಿಸಲಾಗಿದೆ. ಆ ಬಿಟ್ಟುಹೋದ ಪದವನ್ನು ಹೇಳಿಕೆಯ ಎಡಭಾಗದಲ್ಲಿರುವ ಆವರಣದಲ್ಲಿ ಬರೆಯಿರಿ.

ಉದಾಹರಣೆ :

- ( ಅಂಡಾಶಯ ) 1. ಅಂಡಕೋಶವು — ದ ಒಂದು ಭಾಗ.  
( ವಿಕಾಸ ) 2. ಕಬ್ಬಿಣವನ್ನು ಕಾಯಿಸಿದಾಗ ಅದು — ಗೊಳ್ಳುತ್ತದೆ.

ಇದೇ ರೀತಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

- ( ) 1. ಫಾರಿನ್‌ಹೀಟ್ ಉಷ್ಣಮಾಪಿಯ ಕೆಳಗಿನ ಆದರ್ಶಬಿಂದುವು — ಡಿಗ್ರಿಗಳು.  
( ) 2. ಕಂಬಳಿಹುಳುವು ಸಸಿಗಳ — ನ್ನು ತಿನ್ನುತ್ತದೆ.  
( ) 3. ಎಲೆಗಳಲ್ಲಿರುವ ಹಸುರು ವಸ್ತುವು — .  
( ) 4. ಕಬ್ಬಿಣವು ತುಕ್ಕುಹಿಡಿಯುವುದು — ಬದಲಾವಣೆಗೆ ಉದಾಹರಣೆ.  
( ) 5. — ಪದ್ಧತಿಯಲ್ಲಿ ಚದರ ಗಜವು ವಿಸ್ತೀರ್ಣದ ಮೂಲಮಾನ.  
( ) 6. ಎಡ ಹೃತ್ಪುರ್ಣಕ್ಕೆ — ರಕ್ತವು ಬಂದು ಸೇರುತ್ತದೆ.  
( ) 7. ಮಂಜುಗಡ್ಡೆಯ ಕರಗುವಿಕೆಯು — ಬದಲಾವಣೆ.  
( ) 8. — ನ್ನು ಪ್ರಕೃತಿಯ ರೈತ ಎಂದು ಕರೆಯುತ್ತಾರೆ.  
( ) 9. ಚಿಟ್ಟೆಯು ಹೂವಿನ ಮಕರಂದವನ್ನು — ನಿಂದ ಹೀರುತ್ತದೆ.  
( ) 10. ಗಂಧಕ ಮತ್ತು ಕಬ್ಬಿಣದ ರಜಗಳ ಮಿಶ್ರಣವನ್ನು — ನ್ನು ಉಪಯೋಗಿಸಿ ಬೇರ್ಪಡಿಸ ಬಹುದು.

### ವರ್ಗೀಕರಣ ಪರೀಕ್ಷೆ

ಸೂಚನೆ—ಈ ಕೆಳಗಿನ ಅಂಶಗಳಲ್ಲಿ ಒಂದು ಅಂಶವು ಮಾತ್ರ ಭಿನ್ನಗುಂಪಿಗೆ ಸೇರಿದೆ. ಉಳಿದವು ಒಂದೇ ಗುಂಪಿಗೆ ಸೇರಿವೆ. ವಿಭಿನ್ನ ಗುಂಪಿಗೆ ಸೇರಿದ ಆ ಪದವನ್ನು ಆವರಣದಲ್ಲಿನ ಜಾಗದಲ್ಲಿ ಬರೆಯಿರಿ.

ಉದಾಹರಣೆ :

- ( ಶ್ವಾಸಕೋಶ ) 1. ಕಣ್ಣು, ನಾಲಿಗೆ, ಮೂಗು, ಶ್ವಾಸಕೋಶ, ಕಿವಿ.  
( ಸ್ನಿಗ್ಧತ್ವ ) 2. ಸ್ನಿಗ್ಧತ್ವ, ದೃಢತ್ವ, ತಾಂತವತೆ, ಪತ್ರರೂಪಕ್ಷಮತ್ವ, ಧಾರಣಸಾಮರ್ಥ್ಯ.

ಮೊದಲಿನ ಉದಾಹರಣೆಯಲ್ಲಿ ಶ್ವಾಸಕೋಶವನ್ನು ಬಿಟ್ಟು ಉಳಿದ ನಾಲ್ಕು ಅಂಶಗಳೂ ಪಂಚೇಂದ್ರಿಯಗಳ ಗುಂಪಿಗೆ ಸೇರಿವೆ. ಆದ್ದರಿಂದ ಶ್ವಾಸಕೋಶ ಎಂಬ ಪದವನ್ನು ಆವರಣದಲ್ಲಿ ಬರೆದಿದೆ. ಎರಡನೆಯ ಉದಾಹರಣೆಯಲ್ಲಿ ಸ್ನಿಗ್ಧತ್ವವನ್ನು ಬಿಟ್ಟು ಉಳಿದವು ಘನವಸ್ತುವಿನ ಗುಣಗಳು. ಆದ್ದರಿಂದ ಆವರಣದಲ್ಲಿ ಸ್ನಿಗ್ಧತ್ವ ಎಂದು ಬರೆದಿದೆ.

ಇದೇ ರೀತಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

- ( ) 1. ಅಂಡಕೋಶ, ಕೇಸರ, ಪುಷ್ಪಪಾತ್ರ, ಪುಷ್ಪದಳ, ಪತ್ರರಂಧ್ರಗಳು.
- ( ) 2. ನೀರು, ಹಾಲು, ಪಾದರಸ, ಮಣ್ಣು, ಎಣ್ಣೆ.
- ( ) 3. ಅಮ್ಲಜನಕ, ಇಂಗಾಲ, ಸೋಡಿಯಂ, ಮ್ಯಾಗ್ನೀಷಿಯಂ, ಇಂಗಾಲದ ಡೈ ಆಕ್ಸೈಡ್.
- ( ) 4. ಅಡಿ, ಅಂಗುಲ, ಸೆಂಟಿಮೀಟರ್, ಗ್ರಾಂ, ಮೀಟರ್.
- ( ) 5. ಹೂವು, ಎಲೆಗಳು, ಬೇರು, ಕಾಂಡ, ಕೊಂಬೆ.
- ( ) 6. ಮಸೀಪೂರಕ, ಪಿಚಕಾರಿ, ಉಷ್ಣ ಮಾಪಿ, ಸೈಕಲ್ ಪಂಪ್, ಫುಟ್‌ಬಾಲ್ ಪಂಪ್.
- ( ) 7. ಬೀಜದ ಸಿವೆ, ಪರಾಗಕೋಶ, ಬೀಜದಳ, ಪ್ರಥಮ ಕಾಂಡ, ಪ್ರಥಮ ಮೂಲ.
- ( ) 8. ಈರುಳ್ಳಿ, ಹೂವು, ಮೂಲಂಗಿ, ಕೋಸು, ಶುಂಠಿ.
- ( ) 9. ಮ್ಯಾಂಗನೀಸ್ ಡೈ ಆಕ್ಸೈಡ್, ಮದ್ದಿನ ಪುಡಿ, ಕಬ್ಬಿಣದ ಸಲ್ಫೈಡ್, ಪೊಟಾಸಿಯಂ ಕ್ಲೋರೈಟ್, ಸೋಡಿಯಂ ಹೈಡ್ರಾಕ್ಸೈಡ್.
- ( ) 10. ಯಕೃತ್ತು, ಬಲ ಹೃತ್ಪರ್ಣ, ಬಲ ಹೃತ್ಪಕ್ಷಿ, ಎಡ ಹೃತ್ಪರ್ಣ, ಎಡ ಹೃತ್ಪಕ್ಷಿ.

### ಸಂಬಂಧಕಲ್ಪನಾ ಪರೀಕ್ಷೆ

ಸೂಚನೆ—ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳಲ್ಲಿನ ಮೊದಲಿನ ಎರಡು ಅಂಶಗಳಿಗೆ ಪರಸ್ಪರ ಸಂಬಂಧವಿದೆ. ಈ ಸಂಬಂಧವನ್ನು ಅರ್ಥಮಾಡಿಕೊಂಡು ಅದೇ ರೀತಿಯಲ್ಲಿ ಮೂರನೆಯ ಮತ್ತು ನಾಲ್ಕನೆಯ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧ ಕಲ್ಪಿಸುವಂತೆ ನಾಲ್ಕನೆಯ ಅಂಶವನ್ನು ಕಂಡುಹಿಡಿದು ಅವರಣದಲ್ಲಿರುವ ಜಾಗದಲ್ಲಿ ಬರೆಯಿರಿ.

ಉದಾಹರಣೆ :

(ಸಂಕೋಚಗೊಳ್ಳುತ್ತದೆ) 1. ಶಾಖ : ವಿಕಾಸಹೊಂದುತ್ತದೆ :: ಶೈತ್ಯ : —

(ದ್ರವ) 2. ಅಮ್ಲಜನಕ : ಅನಿಲ :: ನೀರು : —

ಶಾಖದಿಂದ ವಸ್ತುಗಳು ವಿಕಾಸಹೊಂದುತ್ತವೆ; ಶೈತ್ಯದಿಂದ ಸಂಕೋಚಗೊಳ್ಳುತ್ತವೆ. ಆದ್ದರಿಂದ ಮೊದಲಿನ ಉದಾಹರಣೆಯಲ್ಲಿನ ಅವರಣದಲ್ಲಿ ಸಂಕೋಚಗೊಳ್ಳುತ್ತವೆ ಎಂದು ಬರೆದಿದೆ. ಅಮ್ಲಜನಕವು ಅನಿಲ, ನೀರು ದ್ರವ. ಆದ್ದರಿಂದ ಎರಡನೆಯ ಉದಾಹರಣೆಯಲ್ಲಿನ ಅವರಣದಲ್ಲಿ ದ್ರವ ಎಂದು ಬರೆದಿದೆ.

ಇದೇ ರೀತಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

- ( ) 1. ಉಷ್ಣನಯನ : ದ್ರವಗಳು :: ಉಷ್ಣವಹನ : —
- ( ) 2. ಸೆಂಟಿಗ್ರೇಡ್ ಅಳತೆ : 100 :: ಫಾರಿನ್‌ಹೀಟ್ ಅಳತೆ : —
- ( ) 3. ವಾಯುಭಾರಮಾಪಿ : ಸಮುದ್ರ :: ಉಷ್ಣಮಾಪಿ : —
- ( ) 4. 1 ಸೆಂಟಿಮೀಟರ್ : 10 ಮಿಲಿಮೀಟರ್ :: 1 ಅಡಿ : —
- ( ) 5. ಗಾಳಿ : ಶ್ವಾಸನಾಳ :: ಆಹಾರ : —
- ( ) 6. ಪ್ರಥಮ ಕಾಂಡ : ಕಾಂಡ :: ಪ್ರಥಮ ಮೂಲ : —



(	)	7. ಆಲೂಗೆಡ್ಡೆ	:	ಟ್ಯೂಬರ್	:	:	ಈರುಳ್ಳಿ	:	—
(	)	8. ವಜ್ರ	:	ಕಠಿಣ	:	:	ಗ್ರಾಫೈಟ್	:	—
(	)	9. ಗಡ	:	ಬೀಜ	:	:	ಪಕ್ಷಿ	:	—
(	)	10. ಗಾಳಿ	:	ಮಿಶ್ರಣ	:	:	ನೀರು	:	—

### ಸಂಖ್ಯಾ ಪರೀಕ್ಷೆ

ಸೂಚನೆ—ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳಿಗೆ ಉತ್ತರವನ್ನು ಬಿಟ್ಟಿರುವ ಜಾಗಗಳಲ್ಲಿ ಬರೆಯಿರಿ.

ಉದಾಹರಣೆ :

- I. ಮನುಷ್ಯಶರೀರದ ಮೂರು ಮುಖ್ಯ ಭಾಗಗಳನ್ನು ತಿಳಿಸಿ :  
(1) ರುಂಡ, (2) ಮುಂಡ, (3) ಕೈಕಾಲುಗಳು.

- II. ನೀರಿನಲ್ಲಿರುವ ಎರಡು ಮೂಲವಸ್ತುಗಳನ್ನು ತಿಳಿಸಿ :  
(1) ಆವ್ಲಜನಕ, (2) ಜಲಜನಕ.

ಇದೇ ರೀತಿ ಈ ಕೆಳಗಿನ ಪ್ರಶ್ನೆಗಳನ್ನು ಉತ್ತರಿಸಿ :

- ಜಲಜನಕವನ್ನು ಪ್ರಯೋಗಶಾಲೆಯಲ್ಲಿ ತಯಾರಿಸುವಾಗ ಉಪಯೋಗಿಸುವ ಎರಡು ರಸಾಯನಿಕ ವಸ್ತುಗಳನ್ನು ತಿಳಿಸಿ : (1) (2)
- ಆವ್ಲಜನಕದ ಎರಡು ಮುಖ್ಯ ಉಪಯೋಗಗಳನ್ನು ತಿಳಿಸಿ :  
(1)  
(2)
- ಇಂಗಾಲದ ಮೂರು ಬಹುರೂಪಗಳನ್ನು ತಿಳಿಸಿ :  
(1) (2) (3)
- ವಾಯುಭಾರಮಾಪಿಯ ಎರಡು ಉಪಯೋಗಗಳನ್ನು ತಿಳಿಸಿ :  
(1)  
(2)
- ಬ್ರಾಹ್ಮ ಮರ್ದನಯಂತ್ರದ ಎರಡು ಉಪಯೋಗಗಳನ್ನು ತಿಳಿಸಿ :  
(1)  
(2)
- ಶಾಖಪ್ರಸಾರವಾಗುವ ಮೂರು ಕ್ರಮಗಳನ್ನು ತಿಳಿಸಿ :  
(1) (2) (3)
- ವಾಯುಭಾರಮಾಪಿಯಲ್ಲಿ ಪಾದರಸವನ್ನು ಉಪಯೋಗಿಸಲು ಮೂರು ಕಾರಣಗಳನ್ನು ತಿಳಿಸಿ :  
(1)  
(2)  
(3)
- ಮಣ್ಣಿನ ಮೂರು ಭಾಗಗಳನ್ನು ತಿಳಿಸಿ :  
(1)  
(2)  
(3)

## ಚಿತ್ರ ಪರೀಕ್ಷೆ

I.

1. ಈ ಚಿತ್ರವು ಏನನ್ನು ಸೂಚಿಸುತ್ತದೆ ?

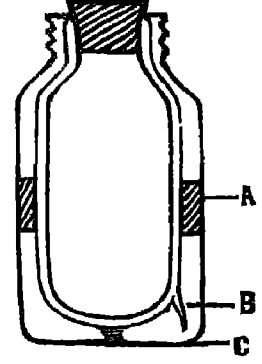
.....

2. ಇಲ್ಲಿ ಸೂಚಿಸಿರುವ ಭಾಗಗಳ ಹೆಸರನ್ನು ತಿಳಿಸಿ :

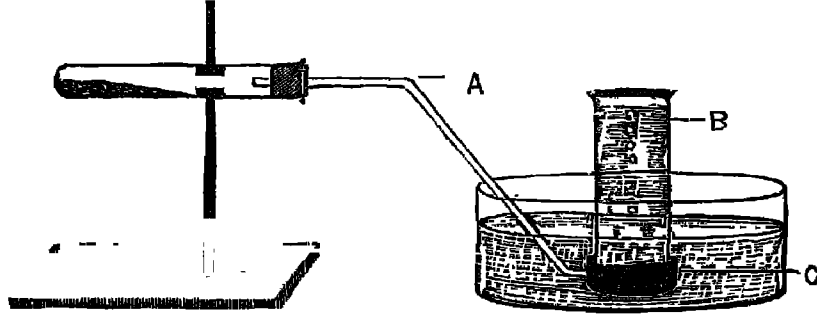
A.....

B.....

C:.....



II. ಪ್ರಯೋಗಶಾಲೆಯಲ್ಲಿ ಆಮ್ಲ ಜನಕವನ್ನು ತಯಾರಿಸುವಿಕೆ :



1. ಚಿತ್ರದಲ್ಲಿ ಬಿಟ್ಟುಹೋಗಿರುವ ಭಾಗವು ಯಾವುದು ?

.....

2. ಗುರುತಿಸಿರುವ ಭಾಗಗಳ ಹೆಸರನ್ನು ತಿಳಿಸಿ :

A.....

B.....

C.....

3. ಪ್ರನಾಳದಲ್ಲಿ ಹಾಕುವ ಎರಡು ವಸ್ತುಗಳನ್ನು ತಿಳಿಸಿ :

(i) .....

(ii) .....

4. ಆ ಎರಡು ವಸ್ತುಗಳಲ್ಲಿ ಯಾವುದು ಆಮ್ಲ ಜನಕವನ್ನು ಕೊಡುತ್ತದೆ ?

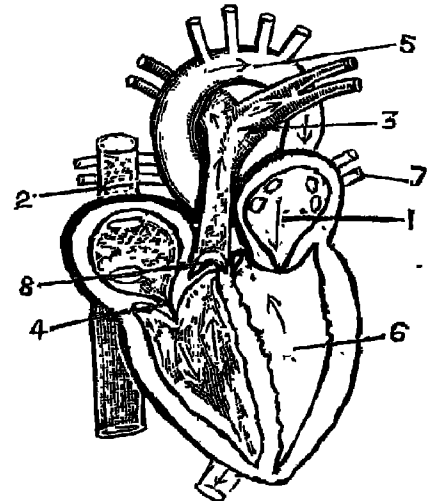
.....

5. ಈ ಸಂದರ್ಭದಲ್ಲಿ ಆಮ್ಲ ಜನಕವನ್ನು ನೀರಿನ.....ಮುಖ ಸ್ಥಾನಪಲ್ಲಟದಿಂದ ಶೇಖರಿಸುತ್ತೇವೆ.

III. ಮನುಷ್ಯನ ಹೃದಯದ ನೀಳಚ್ಛೇದ :

ಈ ಚಿತ್ರದಲ್ಲಿ ಕೆಲವು ಮುಖ್ಯ ಭಾಗಗಳನ್ನು ಸಂಖ್ಯೆಗಳಿಂದ ಗುರುತಿಸಿದೆ. ಅವುಗಳ ಹೆಸರುಗಳನ್ನು ಕೆಳಗೆ ಬರೆಯಲಾಗಿದೆ. ಪ್ರತಿ ಭಾಗಕ್ಕೂ ಅನುಗುಣವಾದ ಸಂಖ್ಯೆಯನ್ನು ಕಂಡುಹಿಡಿದು ಅವರಣದಲ್ಲಿನ ಜಾಗದಲ್ಲಿ ಬರೆಯಿರಿ.

ಅಯೋರ್ಟಾ	...	( )
ಎಡ ಹೃತ್ಪುರ್ಣ	....	( )
ಟ್ರೈಕಸ್ಪೈಡ್ ಕವಾಟ	....	( )
ಪಲ್ಮನರಿ ಆರ್ಟರಿ	....	( )
ಅರ್ಥಚಂದ್ರಾಕೃತಿಯ ಕವಾಟ	....	( )
ಉಜ್ಜಮಲಿನ ರಕ್ತನಾಳ	....	( )
ಪಲ್ಮನರಿ ವೇಯಿನ್	....	( )
ಎಡ ಹೃತ್ಪುಷ್ಪಿ	....	( )





Administration of Achievement Test in General Science in the various schools of the State.

P R O G R A M M E

Sl. No.	Date.	Time.	Place	Name of the School.	No. of Students in H.S. II Year.		TOTAL
					Eng. Medium.	Kan. Medium	
1	2	3	4	5	6	7	8
1	23-1-1961	11 A.M.	Mysore	Sri Ramakrishna Vidyalaya High School	40	..	40
2	do	3 P.M.	do	Vidyavardhaka High School	40	40	80
3	24-1-1961	11 A.M.	do	Marivan's High School	40	40	80
4	do	3 P.M.	do	Christ The King Convent	40	40	80
5	25-1-1961	11 A.M.	do	St. Philomena's High School	40	40	80
6	27-1-1961	11 A.M.	Ganigal	Govt. Boys High School	40	40	80
7	do	3 P.M.	Tumkur	Govt. Boys High School	40	40	80
8	28-1-1961	11 A.M.	do	Empress Girls High School	40	40	80
9	30-1-1961	11 A.M.	do	Siddaganga High School	40	40	80
10	do	3 P.M.	do	Sarvodaya High School	40	40	80
11	31-1-1961	11 A.M.	Bangalore	Malleswarum High School	40	40	80
12	do	3 P.M.	do	Central High School	40	40	80
13	1-2-1961	11 A.M.	do	National High School	40	40	80
14	do	3 P.M.	do	Vani Vilas Institute	40	40	80



1	2	3	4	5	6	7	8
15	2-2-1961	11 A.M.	Bangalore	Corporation High School - Taskar Town	40	..	40
16	3-2-1961	11 A.M.	Mandya	Govt. Boys High School	40	40	80
17	do	12-30 PM	do	St. Joseph Convent	40	40	80
18	do	2-15 P.M.	do	Mysugar High School	40	40	80
19	4-2-1961	8 A.M.	do	Municipal High School	..	80	80
20	6-2-1961	11 A.M.	Chamarajanagar.	Municipal High School	40	40	80
21	do	12-30 PM	do	Sri Shivarathreswara High School	..	40	40
22	do	3 P.M.	Nanjangud	Govt. Boys High School	40	40	80
23	7-2-1961	11 A.M.	Krishnaraaja- Nagar.	District Board High School,	..	80	80
24	8-2-1961	11 A.M.	Sailegrama	Municipal High School	..	80	80
25	10-2-1961	11 A.M.	Pandavapura	Vijaya High School	..	80	80
26	do	2-30 PM	Srirangapata	Municipal High School	..	80	80
27	13-2-1961	11 A.M.	Tumkur	Aryan High School	40	40	80



*Appendix E*

C.Rangachar, B.Sc., M.Ed.(Leeds),  
Principal

Teachers' College,  
Mysore,  
20th January 1961.

Sir/Madam,

Sri G.M.Khan Ghori, a Final Year M.Ed. student of this College has constructed an Achievement Test in 'General Science' for High School II Year class. To standardize this test, he wants to administer it to a group of students of your school as detailed below. At the same time, he requires the following information about each candidate to whom the test is administered in your school.

1. The test marks and the first terminal examination marks of the candidate in 'General Science'.
2. Name 10 best and 10 worst students regarding their Achievement in General Science as per the estimate of the subject teachers.

The number of candidates required for the test is:

Class: H.S. II Year:	Eng. Medium	Kan. Medium.	Total
----------------------	-------------	--------------	-------

The time required for the test is one hour. The date and time of administration of the Test:

A fairly spacious room or hall may be spared for conducting the test under examination conditions.

I request you kindly to cooperate in this educational endeavour and give Sri Khan Ghori all the necessary help and information for the successful conduct of the Test.

Thanking you,

Yours faithfully,

(C.Rangachar)  
Principal

To

The Head Master/Head Mistress,  
..... High School,  
.....





*Appendix F*

Reg.No.	Odd	Even	Reg.No.	Odd.	Even.
1	2	3	1	2	3
5	11	18	120	31	30
10	30	28	125	24	30
15	30	33	130	24	21
20	32	29	135	28	34
25	22	20	140	34	32
30	24	24	145	31	32
35	21	25	150	33	30
40	8	12	155	41	37
45	25	20	160	29	29
50	28	26	165	29	30
55	22	20	170	22	24
60	40	39	175	38	35
65	15	11	180	24	34
70	24	21	185	32	37
75	20	15	190	41	43
80	28	23	195	33	28
85	32	26	200	29	32
90	38	41	205	29	34
95	11	9	210	22	17
100	17	11	215	24	20
105	17	12	220	26	31
110	27	26	225	31	30
115	21	26	230	21	26



1	2	3	1	2	3
485	22	23	610	31	36
490	33	41	615	18	18
500	22	25	620	14	20
505	18	17	625	17	12
510	26	26	630	12	12
515	30	28	635	32	29
520	43	42	640	15	13
525	27	22	645	16	12
530	16	21	650	18	22
535	39	43	655	30	30
540	32	24	660	24	25
545	40	38	665	22	16
550	20	21	670	31	27
555	28	33	675	40	38
560	26	29	680	28	31
565	19	23	685	32	29
570	17	21	690	30	28
575	19	22	695	26	30
580	11	18	700	10	18
585	15	15	705	23	30
590	14	21	710	40	42
595	20	23	715	18	22
600	24	28	720	29	28
605	19	17	725	25	22



---

---

730	26	20	855	34	37
735	37	31	860	33	41
740	24	22	865	26	25
745	23	21	870	28	37
750	39	37	875	29	32
755	21	25	880	31	38
760	21	20	885	40	39
765	27	27	890	29	29
770	21	16	895	40	40
775	36	32	900	25	30
780	34	39	905	25	31
785	32	34	910	46	49
790	16	15	915	44	44
795	27	24	920	39	33
800	25	27	925	32	30
805	34	32	930	29	33
810	31	27	935	28	30
815	26	25	940	29	35
820	27	31	945	21	20
825	36	36	950	30	21
830	22	24	955	29	29
835	29	26	960	25	25
840	30	27	965	27	27
845	20	22	970	29	28
850	27	31	975	36	37



1	2	3	1	2	3
980	37	33	1105	25	31
985	35	33	1110	31	28
990	35	33	1115	24	24
995	25	31	1120	24	23
1000	29	28	1125	36	41
1005	23	28	1130	36	35
1010	36	36	1135	30	31
1015	23	21	1140	33	36
1020	34	33	1145	20	16
1025	36	35	1150	37	38
1030	24	17	1155	29	29
1035	13	10	1160	29	31
1040	29	28	1165	37	39
1045	35	35	1170	9	16
1050	19	29	1175	30	33
1055	18	20	1180	41	38
1060	26	26	1185	36	40
1065	29	26	1190	20	26
1070	16	17	1195	14	14
1075	17	17	1200	23	23
1080	20	19	1205	9	3
1085	19	22	1210	9	13
1090	18	24	1215	18	16
1095	17	20	1220	19	12
1100	14	17	1225	17	18





1	2	3	1	2	3
1230	19	16	1355	24	27
1235	36	34	1360	29	25
1240	32	30	1365	27	20
1245	32	32	1370	33	33
1250	35	35	1375	36	36
1255	37	32	1380	23	19
1260	26	29	1385	21	18
1265	31	33	1390	24	27
1270	24	25	1395	35	36
1275	25	27	1400	36	37
1280	16	16	1405	36	43
1285	29	35	1410	39	40
1290	26	26	1415	39	41
1295	40	36	1420	22	22
1300	31	37	1425	43	42
1305	33	28	1430	24	25
1310	24	22	1435	30	31
1315	23	21	1440	40	43
1320	22	19	1445	30	30
1325	9	8	1450	34	31
1330	27	24	1455	25	24
1335	22	25	1460	19	13
1340	27	27	1465	16	16
1345	29	29	1470	23	23
1350	26	23	1475	26	17



1	2	3	1	2	3
1480	28	30	1605	21	14
1485	43	44	1610	16	25
1490	32	33	1615	36	34
1495	18	16	1620	18	13
1500	17	19	1625	28	28
1505	14	17	1630	23	20
1510	25	25	1635	34	30
1515	20	15	1640	33	35
1520	24	26	1645	32	31
1525	17	16	1650	23	23
1530	17	17	1655	23	20
1535	16	19	1660	27	22
1540	25	22	1665	35	27
1545	28	30	1670	30	30
1550	31	26	1675	42	37
1555	24	21	1680	25	28
1560	43	35	1685	30	30
1565	24	17	1690	33	32
1570	30	25	1695	35	35
1575	19	25	1700	33	31
1580	17	13 <del>20</del>	1705	38	38
1585	25	26	1710	27	31
1590	14	26	1715	25	27
1595	15	20	1720	32	40
1600	22	17	1725	36	34



1	2	3	1	2	3
1730	33	35	1855	31	33
1735	30	38	1860	35	32
1740	36	36	1865	15	17
1745	35	38	1870	41	39
1750	31	39	1875	36	31
1755	35	40	1880	29	27
1760	32	33	1885	40	43
1765	18	20	1890	28	27
1770	17	12	1895	20	19
1775	26	25	1900	33	31
1780	37	36	1905	37	34
1785	32	31	1910	37	33
1790	26	22	1915	37	34
1795	29	24	1920	17	17
1800	22	29	1925	36	40
1805	36	38	1930	27	32
1810	29	22	1935	23	29
1815	37	30	1940	37	32
1820	26	29	1945	28	28
1825	22	25	1950	22	19
1830	12	11	1955	16	13
1835	25	29	1960	16	19
1840	20	18	1965	25	30
1845	12	11	1970	27	31
1850	14	15	1975	33	37



1	2	3
80	18	20
85	27	32
90	25	19
95	32	38
00	24	28
05	19	18
10	37	38
15	21	19
20	19	17





Statement showing the calculations of the Difficulty value and Discriminating Index.

Sl. No.	Difficulty Value		Discriminating Index.		
	Correct Response.	Percentage.	U Upper one Third.	L Lower One Third.	D.I = $\frac{U - L}{N/3}$
1	2	3	4	5	6
<u>TRUE FALSE TEST</u>					
1	99	58	35	23	0.21
2	132	77	46	34	0.20
3	123	72	46	34	0.20
4	93	55	41	19	0.39
5	58	35	24	21	0.21
6	126	74	43	34	0.19
7	73	41	26	24	0.20
8	87	50	32	23	0.17
9	70	44	26	18	0.15
10	125	73	46	34	0.23
11	54	32	21	11	0.19
12	92	54	32	21	0.20
13	101	59	38	25	0.24
14	92	54	34	26	0.15
15	90	53	33	24	0.19
16	132	77	39	31	0.15
17	113	66	39	24	0.28
18	79	47	33	14	0.35
19	66	39	25	14	0.20
20	100	59	40	28	0.20



1	2	3	4	5	6
21	102	60	38	21	0.31
22	93	55	34	20	0.26
23	90	53	35	20	0.28
24	82	49	30	23	0.31
25	78	46	30	20	0.19
26	85	50	45	21	0.45
27	112	66	31	26	0.10
28	88	52	22	24	..
29	69	46	33	23	0.21
30	75	44	36	19	0.31
31	77	45	50	18	0.60
32	127	76	50	32	0.33
33	120	72	47	28	0.35
34	82	49	35	20	0.20
35	69	41	15	14	..
36	61	37	20	17	..
37	80	49	34	17	0.33
38	65	39	22	17	0.10
39	85	50	29	22	0.13
40	110	66	45	28	0.33
41	121	72	42	34	0.16
42	125	74	48	35	0.24
43	102	59	36	21	0.30
44	102	59	41	21	0.37
45	95	56	43	19	0.44
46	92	54	36	16	0.37



1	2	3	4	5	6
47	91	53	45	18	0.50
48	85	50	31	23	0.15
49	93	55	37	19	0.33
50	90	53	37	21	0.30

MODIFIED TRUE FALSE TEST

1	77	47	30	22	0.15
2	88	52	43	13	0.60
3	100	59	45	20	0.50
4	52	31	15	12	..
5	72	41	31	18	0.24
6	76	45	34	15	0.35
7	80	49	34	12	0.40
8	65	38	33	11	0.40
9	78	46	35	16	0.33
10	67	39	28	16	0.22
11	85	50	37	12	0.50
12	50	30	17	15	..
13	78	46	35	15	0.40
14	94	55	41	20	0.40
15	46	27	18	15	..
16	73	42	31	9	0.40
17	74	42	39	15	0.44
18	33	20	10	9	..
19	90	53	42	20	0.40
20	46	27	19	15	..

—

—

—

1	2	3	4	5	6
21	98	58	44	20	0.44
22	46	27	21	13	0.15
23	97	58	40	20	0.37
24	55	32	21	15	0.13
25	49	29	24	12	0.21
26	41	23	18	16	..
27	46	27	17	11	0.11
28	77	46	33	13	0.40
29	54	32	30	4	0.50
30	81	49	37	17	0.37

MULTIPLE CHOICE TEST

1	129	76	51	32	0.33
2	44	26	24	11	0.30
3	72	42	24	23	..
4	54	32	23	8	0.27
5	48	28	26	10	0.29
6	79	46	35	23	0.22
7	50	30	29	12	0.31
8	77	45	39	18	0.40
9	92	54	41	25	0.30
10	57	33	26	14	0.22
11	80	47	42	11	0.57
12	89	52	32	26	0.10
13	74	41	22	18	..
14	56	33	31	21	0.37



14

15

1	2	3	4	5	6
15	59	36	18	11	0.10
16	29	16	37	4	0.60
17	79	46	44	17	0.50
18	74	41	24	10	0.25
19	38	22	15	5	0.19
20	<del>29</del> 59	<del>36</del>	40	3	0.70
21	73	41	31	7	0.44
22	65	38	12	14	..
23	32	19	22	8	0.25
24	55	33	21	13	0.13
25	32	19	35	6	0.50
26	85	50	36	20	0.30
27	90	53	41	18	0.42
28	89	52	41	23	0.33
29	73	41	40	11	0.53
30	42	25	19	6	0.24

COMPLETION TEST.

1	66	39	40	11	0.53
2	4	2	4	.	..
3	6	3			..
4	40	26	28	3	0.40
5	34	20	20	2	0.33
6	44	27	40	2	0.70
7	12	7	12	.	..
8	26	16	20	3	..



1	2	3	4	5	6
9	38	23	26	6	0.47
10	7	4	12	.	
11	7	4	5		
12	34	2	3		
13	21	12	24	.	.
14	16	9	17	.	.
15	55	33	36	6	0.55
16	44	27	35	2	0.6
17	54	32	33	7	0.5
18	24	15	21	2	0.33
19	18	10	15	.	.
20	20	13	31	3	0.5
21	54	32	31	8	0.4
22	49	29	26	7	0.33
23	21	13	16	3	.
24	14	8	12	3	.
25	40	26	26	2	0.4

CLASSIFICATION TEST

1	97	57	45	14	0.6
2	14	8	7	7	.
3	35	21	7	14	.
4	66	37	32	12	0.33
5	57	33	17	14	.
6	90	53	40	13	0.5



1	2	3	4	5	6
7	69	40	36	13	0.40
8	20	12	9	4	
9	86	51	40	19	0.50
10	10	6	3	4	.
11	25	15	13	5	.
12	92	54	43	11	0.60
13	11	7	5	3	.
14	15	8	4	5	.
15	5	3	22	2	.
16	64	38	26	12	0.22
17	45	27	12	4	0.15
18	80	47	38	13	0.40
19	67	39	28	20	0.15
20	17	10	5	7	.
21	76	45	38	4	0.40
22	99	64	40	23	0.30
23	46	27	23	7	0.30
24	34	20	18	7	0.20
25	38	22	17	7	0.20

#### ANALOGIES TEST

1	55	33	39	1	0.70
2	71	42	42 <sub>5</sub>	6	0.70
3	47	24	39	2	0.70
4	48	29	33	2	0.57
5	17	10	16	.	.



1	2	3	4	5	6
6	29	17	14	..	.
7	43	26	27	4	0.42
8	10	6	9	.	.
9	35	21	21	2	0.33
10	33	20	24	3	0.40
11	23	14	21	1	0.33
12	12	7	8	.	.
13	23	14	17	1	.
14	16	9	14	.	.
15	40	24	24	3	0.40
16	50	30	29	6	0.42
17	31	18	20	1	0.33
18	33	20	21	4	0.31

MATCHING TEST.

1	103	60	51	13	0.70
2	92	54	49	12	0.70
3	97	57	54	11	0.80
4	81	50	49	7	0.77
5	98	57	54	15	0.72
6	48	28	29	2	0.50
7	31	18	18	3	0.28
8	36	21	26	1	.
9	42	25	41	6	0.64
10	39	23	25	4	0.40







1	2	3	4	5	6
13	23	13	19	..	..
14	17	10	13	..	..
15	8	5	2	..	..
16	81	30	33	..	..
17	38	22	26	..	..
18	17	10	12	2	0.10
19	7	4	3	2	
20	47	28	31	2	0.53
21	40	23	24	.	
22	16	9	10	.	
23	73	43	<sup>41</sup> 8	8	0.61
24	70	42	41	5	0.64
25	70	42	45	4	0.72
26	45	26	25	4	0.40
27	46	26	22	5	0.31
28	67	4	30	8	0.40
29	64	38	32	7 9	0.46
30	53	32	26	8	0.30

PROBLEM TEST.

1	3	3	3	.	.
2	23	23	23	.	.
3	4	.	4	.	.
4	13	.	10	.	.
5	10	.	9	.	.

[illegible]

1	2	3	4	5	6
6	16	..	12	..	..
7	47	..	25	5	..
8	2	..	2	.	..
9	4	..	4	.	..
10	26	..	23	2	..
11	6	..	4	.	..
12	21	..	17	1	..
13	3	..	2	.	..
14	16	..	12	.	..
15	6	..	5	1	..

DIAGRAM TEST.

1	92	54	48	16	0.66
2	10	6	7	.	.
3	44	26	21	10	0.20
4	65	40	34	6	0.51
5	90	53	39	19	0.33
6	33	20	19	4	0.30
7	13	8	9	.	.
8	48	29	30	6	0.40
9	34	20	27	4	0.40
10	40	23	31	6	0.46
11	29	17	19	3	0.30
12	32	20	2	.	.



1	2	3	4	5	6
13	11	6	9	..	..
14	41	23	25	4	0.40
15	40	23	26	4	0.40
16	25	15	8	.	.
17	58	34	25	10	0.30
18	35	20	23	7	0.30
19	56	33	29	18	0.21
20	27	16	12	9	.
21	55	32	29	16	0.23





Item Number.	Number of correct response.	p	q = (1-p)	p. q.
1	2	3	4	5
1	350	.87	.13	.11
2	325	.80	.20	.16
3	336	.83	.17	.14
4	317	.78	.22	.17
5	179	.44	.56	.25
6	253	.63	.37	.23
7	314	.78	.22	.17
8	215	.53	.47	.25
9	220	.54	.46	.25
10	127	.31	.69	.21
11	213	.53	.47	.25
12	218	.54	.46	.25
13	299	.74	.26	.19
14	230	.57	.43	.25
15	277	.69	.31	.21
16	233	.58	.42	.24
17	195	.48	.52	.25
18	260	.64	.36	.23
19	196	.49	.51	.25
20	127	.31	.69	.21
21	285	.71	.29	.21



1	2	3	4	5
22	202	.50	.50	.25
23	278	.69	.31	.21
24	218	.54	.46	.25
25	223	.55	.45	.25
26	278	.69	.31	.21
27	170	.42	.58	.24
28	65	.16	.84	.13
29	223	.55	.45	.25
30	140	.35	.65	.23
31	371	.92	.08	.09
32	343	.85	.15	.13
33	229	.57	.43	.25
34	250	.62	.38	.24
35	126	.31	.69	.21
36	243	.60	.40	.24
37	316	.78	.22	.17 <del>.27</del>
38	100	.25	.75	.19
39	245	.61	.39	.24
40	176	.44	.56	.25
41	108	.27	.73	.20
42	220	.54	.46	.25
43	241	.60	.40	.24
44	174	.43	.57 <del>.45</del>	.25
45	298	.74	.26	.19



1	2	3	4	5
46	266	.66	.34	.22
47	237	.59	.41	.24
48	227	.56	.44	.25
49	247	.61	.39	.24
50	224	.55	.45	.25
51	116	.29	.71	.21
52	276	.68	.32	.22
53	261	.65	.35	.23
54	170	.42	.58	.24
55	192	.48	.52	.25
56	150	.37	.63	.23
57	173	.43	.57	.25
58	288	.71	.29	.21
59	253	.63	.37	.23
60	183	.45	.55	.25
61	234	.58	.42	.24
62	326	.81	.19	.15
63	78	.19	.81	.15
64	278	.69	.31	.21
65	219	.54	.46	.25
66	306	.76	.24	.18
67	225	.56	.44	.25
68	308	.76	.24	.18
69	290	.72	.28	.20



1	2	3	4	5
70	352	.87	.13	.11
71	195	.48	.52	.25
72	144	.36	.64	.23
73	234	.58	.42	.24
74	237	.59	.41	.24
75	132	.33	.67	.22
76	156	.39	.61	.24
77	41	.10	.90	.09
78	193	.48	.52	.25
79	162	.40	.60	.24
80	117	.29	.71	.21
81	180	.45	.55	.25
82	175	.43	.57	.25
83	254	.63	.37	.23
84	178	.44	.56	.25
85	272	.67	.33	.22
86	279	.69	.31	.21
87	253	.63	.37	.23
88	245	.61	.39	.24
89	146	.36	.64	.23
90	118	.29	.71	.21
91	35	.09	.91	.08
92	241	.60	.40	.24
93	238	.59	.41	.24
94	225	.56	.44	.25





1	2	3	4	5
95	180	.45	.55	.25
96	139	.34	.66	.22
97	85	.21	.79	.17
98	202	.50	.50	.25
99	198	.49	.51	.25
100	156	.38	.62	.24
101	308	.76	.24	.18
102	124	.31	<del>.69</del> <del>.96</del>	.21
103	194	.48	.52	.25
104	259	.64	.36	.23
105	266	.66	.34	.22
106	368	.91	.09	.08
107	323	.80	.20	.16
108	253	<del>.63</del> <del>.8</del>	.37	.23
109	177	.44	.56	.25
110	170	.42	.58	.24
111	72	.18	.82	.15
112	178	.44	.56	.25
113	146	.36	.64	.23
114	161	.40	.60	.24
115	107	.27	.73	.20
116	82	.20	.80	.16
117	98	.24	.76	.18
118	88	.22	.78	.17
119	80	.20	.80	.16
120	144	.36	.64	.23



Register Number.	Marks	Register Number.	Marks.
1	2	3	4

**ENGLISH MEDIUM**

Govt.High School,  
Nanjangud;

1	18	21	82
2	74	22	45
3	21	23	64
4	61	24	53
5	27	25	33
6	51	26	62
7	74	<b><u>KANNADA MEDIUM</u></b>	
8	34	27	71
9	37	28	26
10	49	29	28
11	23	30	42
12	41	31	79
13	36	32	41
14	56	33	57
15	62	34	40
16	35	35	39
17	20	36	42
18	36	37	42
19	60	38	48
20	59	39	39





1	2	3	4
89	63	114	47
90	73	115	39
91	43	116	52
92	20	117	49
93	10	118	32
94	13	119	50
95	12	120	56
96	16	121	29
97	66	122	40
98	44	123	30
99	23	124	73
100	21	125	45
101	37	126	66
102	60	127	50
103	41	128	52
104	59	129	30
105	25	130	37
106	20	131	46
107	19	132	50
108	73	133	82
109	73	134	60
110	45	135	57
111	38	136	56
112	59	137	61
<u>KANNADA MEDIUM.</u>		138	55
113	25	139	53



1	2	3	4
140	60	164	60
141	51	165	51
142	74	166	66
143	51	167	46
144	66	168	38
145	55	169	40
146	67	170	40
147	62	171	41
148	60	172	50
149	64	173	50
150	58	174	60
151	61	175	68
152	74	176	66
153	59	177	53
154	60	178	23
155	76	179	53
156	45	180	52
157	63	181	76
158	79	182	64
159	53	183	50
160	52	184	46
<u>Jagadguru Sri Shivara- threswara, ChamaraJanagar.</u>		185	62
		186	74
<u>KANNADA MEDIUM</u>			
161	56	187	62
162	58	188	65
163	57	189	54





1	2	3	4
190	80	213	39
191	47	214	28
192	45	215	35
193	64	216	9
194	63	217	51
195	55	218	54
196	42	219	61
197	65	220	51
198	59	221	53
199	59	222	45
200	53	223	50
201	65	224	38
202	76	225	50
203	75	226	47
204	50	227	60
205	57	228	64
206	64	229	63
207	68	230	41
<u>Municipal High School,</u>		231	49
<u>Srirangapatna.</u>		232	56
<u>KANNADA MEDIUM.</u>			
208	40	233	58
209	59	234	58
210	32	235	65
211	36	236	35
212	75	237	37



1	2	3	4
238	50	260	53
239	40	261	51
240	31	262	40
241	48	263	52
242	41	264	41
243	28	265	37
244	65	266	29
245	51	267	45
246	77	268	50
247	38	269	52
248	44	270	52
249	29	271	54
250	31	272	23
251	65	273	22
252	30	274	23
253	33	275	38
254	50	276	43
255	45	277	14
256	51	278	31
<u>Sri Krishnarajendra</u> <u>Krishnarajanagar</u>		279	28
		280	42
<u>KANNADA MEDIUM.</u>		281	35
		282	67
257	40	283	69
258	54	284	69
259	60		



1	2	3	4
285	58	310	62
286	67	311	60
287	70	312	41
288	59	313	47
289	46	314	26
290	47	315	38
291	67	316	49
292	50	317	32
293	47	318	40
294	30	319	63
295	36	320	62
296	36	321	50
297	27	322	61
298	40	323	75
299	24	324	73
300	17	325	44
301	11	326	54
302	11	327	60
303	29	328	59
304	29	329	71
305	10	330	67
306	13 <del>36</del>	331	47
307	41	332	26
308	47	333	16
309	37	334	74



1	2	3	4
335	69	358	64
336	69	359	59
337	69	360	57
338	66	361	56
339	26	362	50
340	33	363	37
341	30	364	36
342	26	365	30
343	59	366	40
344	69	367	61
345	56	368	35
346	62	369	36
347	71	370	66
<u>Municipal High School,</u> <u>Saligrama.</u>		371	45
		372	47
		373	67
<u>KANNADA MEDIUM</u>		374	52
348	54	375	54
349	66	376	33
350	59	377	55
351	37	378	36
352	59	379	44
353	51	380	60
354	48	381	57
355	42	382	40
356	62	383	26
357	44		





1	2	3	4
384	18	406	58
385	67	407	68
386	46	408	36
387	17	409	76
388	58	410	67
389	67	411	50
390	29	412	59
391	39	413	21
392	47	414	56
393	18	415	66
394	45	416	38
395	48	417	42
396	51	418	61
397	39	419	65
398	75	420	59
<u>Vijaya High School,</u> <u>Pandavapura.</u> <u>KANNADA MEDIUM.</u>		421	39
		422	62
		423	53
		424	57
399	34	425	68
400	75	426	65
401	59	427	42
402	41	428	67
403	48	429	65
404	49	430	65
405	58		



1	2	3	4
480	49	503	35
481	25	504	38
482	20	505	26
483	27	506	26
484	21	507	47
485	39	508	20
486	24	509	43
487	71	510	44
488	36	511	31
489	47	512	40
490	67	513	47
491	67	514	78
492		515	51
<u>KANNADA MEDIUM</u>		516	23
492	18	517	65
493	12	518	44
494	42	519	30
495	35	520	84
496	73	521	38
497	51	522	40
498	35	523	24
499	22	524	23
500	39	525	41
501	32	526	44
502	71	527	29



1	2	3	4
528	24	550	35
529	35	551	57
530	29	552	46
531	35	553	42
<u>Sri Siddaganga High School,</u> <u>Tumkur.</u> <u>ENGLISH MEDIUM</u>		554	38
		555	54
		556	29
		557	51
532	59	558	73
533	64	559	56
534	41	560	47
535	78	561	17
536	45	562	56
537	48	563	77
538	12	564	29
539	20	565	32
540	52	566	33
541	41	567	81
542	49	568	41
543	77	569	42
544	30	570	30
545	73	571	43
546	26	<u>KANNADA MEDIUM</u>	
547	59	572	57
548	51	573	52
549	61		



1	2	3	4
574	25	600	48
575	31	601	47
576	23	602	35
577	16	603	15
578	44	604	16
579	40	605	30
580	21	606	45
581	39	607	52
582	46	608	27
583	55	609	28
584	25	610	64
585	21	<u>Government High School, Tumkur.</u>	
586	10		
587	47	<u>ENGLISH MEDIUM.</u>	
588	28	611	63
589	56	612	30
590	29	613	26
591	69	614	75
592	23	615	30
593	17	616	40
594	45	617	39
595	37	618	15
596	24	619	35
597	55	620	25
598	50	621	36
599	27	622	36





1	2	3	4
623	12	649	23
624	19	650	34
625	21	651	14
626	9	652	45
627	16	653	22
628	14	654	47
629	51	655	56
630	14	656	30
631	29	657	26
632	23	658	29
633	66	<u>KANNADA MEDIUM</u>	
634	54	659	32
635	55	660	39
636	49	661	27
637	29	662	44
638	34	663	47
639	29	664	41
640	18	665	32
641	27	666	53
642	27	667	36
643	24	668	71
644	44	669	61
645	22	670	55
646	45	671	48
647	37	672	57
648	30	673	85



1	2	3	4
718	56	744	70
719	33	745	40
720	47	746	47
721	51	747	62
722	66	748	22
723	48	749	50
724	37	750	71
725	40	751	41
726	51	752	60
727	58	753	26
728	22	754	58
729	54	755	37
730	40	756	51
731	67	757	51
732	61	758	42
733	69	759	47
734	79	760	31
735	61	761	14
736	27	762	66
737	61	763	60
738	68	764	61
739	30	765	46
740	41	766	53
741	54	767	53
742	20	768	62
743	41	769	63



1	2	3	4
770	34	794	73
771	42	795	43
772	71	796	45
773	55	797	19
774	39	798	29
775	63	799	85
<u>ENGLISH MEDIUM.</u>		800	44
776	39	801	46
777	13	802	48
778	21	803	58
779	60	804	77
780	71	805	64
781	22	806	69
782	23	807	37
783	43	808	21
784	25	809	35
785	60	<u>Mahatma Gandhi High School,</u>	
786	85	<u>Kunigal.</u>	
787	49	<u>ENGLISH MEDIUM.</u>	
788	25	810	49
789	65	811	44
790	24	812	66
791	20	813	41
792	28	814	45
793	42	815	42



1	2	3	4
816	48	842	51
817	40	843	53
818	46	844	49
819	51	845	34
820	50	<u>KANNADA MEDIUM.</u>	
821	49	846	58
822	69	847	52
823	69	848	51
824	66	849	65
825	68	850	53
826	26	851	42
827	71	852	71
828	39	853	17
829	69	854	65
830	38	855	65
831	64	856	45
832	33	857	38
833	31	858	55
834	36	859	65
835	45	860	71
836	45	861	51
837	74	862	68
838	65	863	59
839	76	864	38
840	50	865	43
841	45	866	55





1	2	3	4
867	50	<u>Sri Ramakrishna Vidyalaya,</u> <u>Mysore.</u> <u>ENGLISH MEDIUM.</u>	
868	49		
869	64		
870	60	892	94
871	65	893	74
872	63	894	78
873	59	895	78
874	63	896	45
875	57	897	61
876	61	898	61
877	38	899	33
878	59	900	49
879	59	901	55
880	65	902	66
881	65	903	59
882	62	904	80
883	66	905	46
884	49	906	80
885	73	907	42
886	30	908	44
887	47	909	71
888	57	910	94
889	46	911	69
890	54	912	49
891	74	913	59



1	2	3	4
914	69	937	60
915	86	938	68
916	66	939	85
917	71	940	58
918	48	941	39
<u>St. Philomena H.S., Mysore.</u>		942	37
<u>KANNADA MEDIUM</u>		943	51
919	79	944	37
920	66	945	33
921	26	946	35
922	51	947	33
923	42	948	32
924	51	949	67
925	56	950	46
926	38	951	38
927	35	952	51
928	65	953	48
929	73	954	47
930	57	955	50
931	74	956	39
932	39	957	30
933	78	958	42
934	68	959	32
935	52	960	44
936	62	961	52



1	2	3	4
962	44	986	45
963	51	987	55
964	65	988	51
965	46	989	62
966	32	990	62
967	41	991	40
968	35	992	50
969	51	993	41
970	50	994	51
971	51	995	52
972	59	996	29
973	79	997	26
974	81	998	33
975	68	999	38
<u>ENGLISH MEDIUM</u>		1000	50
976	46	1001	39
977	44	1002	31
978	43	1003	40
979	47	1004	23
980	63	1005	42
981	45	1006	34
982	63	1007	48
983	64	1008	55
984	62	1009	50
985	60	1010	66



1	2	3	4
1011	46	1036	26
1012	58	1037	40
1013	22	<u>Christ The King Convent</u>	
1014	23	<u>High School, Mysore.</u>	
1015	41	<u>KANNADA MEDIUM</u>	
1016	48	1038	42
1017	33	1039	76
1018	49	1040	50
1019	33	1041	75
1020	61	1042	48
1021	58	1043	35
1022	33	1044	52
1023	47	1045	61
1024	55	1046	53
1025	61	1047	40
1026	43	1048	46
1027	47	1049	37
1028	39	1050	33
1029	25	1051	32
1030	32	1052	32
1031	23	1053	50
1032	32	1054	28
1033	19	1055	31
1034	26	1056	40
1035	15	1057	29





1	2	3	4
1058	44	1083	23
1059	49	1084	28
1060	47	1085	37
1061	35	1086	39
1062	35	1087	41
1063	62	1088	35
1064	65	1089	63
1065	50	1090	35
1066	36	1091	42
1067	40	1092	53
1068	36	1093	59
1069	44	1094	44
1070	27	1095	31
1071	46	<u>ENGLISH MEDIUM.</u>	
1072	46	1096	75
1073	35	1097	46
1074	28	1098	40
1075	27	1099	33
1076	47	1100	27
1077	40	1101	36
1078	39	1102	71
1079	60	1103	54
1080	38	1104	74
1081	41	1105	50
1082	49	1106	62



1	2	3	4
1107	31	1132	32
1108	30	1133	71
1109	54	1134	37
1110	50	1135	54
1111	50	1136	42
1112	43	1137	18
1113	51	1138	64
1114	37	1139	44
1115	42	1140	59
1116	61	1141	69
1117	39	1142	37
1118	55	1143	47
1119	34	1144	19
1120	37	1145	30
1121	35	1146	42
1122	62	1147	23
1123	24	1148	25
1124	59	1149	28
1125	73	<u>Maharani's High School</u>	
1126	35	<u>Mysore.</u>	
1127	44	<u>KANNADA MEDIUM.</u>	
1128	54	1150	73
1129	80	1151	47
1130	63	1152	32
1131	30	1153	67



1	2	3	4
1154	48	1178	64
1155	54	1179	41
1156	42	1180	79
1157	58	1181	80
1158	47	1182	45
1159	55	1183	80
1160	53	1184	68
1161	61	1185	75
1162	49		
1163	45	<u>ENGLISH MEDIUM.</u>	
1164	49	1186	9
1165	70	1187	17
1166	68	1188	21
1167	39	1189	22
1168	56	1190	35
1169	41	1191	61
1170	24	1192	22
1171	48	1193	28
1172	53	1194	29
1173	69	1195	21
1174	27	1196	8
1175	57	1197	52
1176	62	1198	32
1177	24	1199	76



1	2	3	4
1200	41	1224	29
1201	19	1225	26
1202	14	1226	16
1203	35	1227	24
1204	14	1228	25
1205	7	1229	24
1206	56	1230	26
1207	36	1231	13
1208	27	1232	12
1209	22	1233	15
1210	13	1234	25
1211	15		
1212	Absent.	<u>Vidyavardhaka High School,</u> <u>Mysore.</u>	
1213	28	<u>KANNADA MEDIUM</u>	
1214	14	1235	68
1215	27	1236	79
1216	30	1237	65
1217	30	1238	49
1218	43	1239	74
1219	30	1240	57
1220	24	1241	50
1221	6	1242	65
1222	28	1243	66
1223	25	1244	69





1	2	3	4
1245	58	1267	50
1246	37	1268	57
1247	72	1269	22
1248	72	1270	41
1249	72	1271	75
1250	64	1272	70
1251	59	1273	45
1252	54	1274	75
1253	62	1275	47
1254	54	1276	34
1255	61	1277	21
1256	58	1278	20
1257	47	1279	20
1258	65	1280	23
1259	63	1281	36
1260	50	1282	12
1261	46	1283	25
1262	69	1284	68
1263	60	1285	61
1264	53	1286	66
1265	57	1287	49
		1288	38
<u>ENGLISH MEDIUM.</u>		1289	40
1266	47	1290	44



1	2	3	4
1291	71	1312	51
1292	71	1313	32
1293	42	1314	69
1294	9	1315	34
1295	68	1316	44
1296	74	1317	37
1297	71	1318	32
1298	66	1319	35
1299	75	1320	32
1300	64	1321	65
<u>Vani Vilas High School,</u>		1322	52
<u>Bangalore.</u>		1323	48
<u>KANNADA MEDIUM.</u>		1324	51
		1325	45
1301	46		
1302	51	1326	45
1303	42	1327	32
1304	42	1328	70
1305	52	1329	63
1306	58	1330	47
1307	34	1331	47
1308	45	1332	48
1309	50	1333	39
1310	36	1334	72
1311	58	1335	41



1	2	3	4
1336	45	1359	59
1337	45	1360	51
1338	43	1361	25
1339	40	1362	20
1340	44	1363	30
1341	30	1364	25
1342	34	1365	41
1343	43	1366	11
1344	27	1367	20
1345	51	1368	24
1346	42	1369	23
1347	60	1370	63
1348	33	1371	28
1349	45	1372	60
1350	42	1373	56
1351	30	1374	68
1352	50	1375	68
<u>ENGLISH MEDIUM.</u>		1376	53
		1377	51
		1378	59
1353	32	1379	59
1354	38	1380	38
1355	46	1381	26
1356	45	1382	34
1357	46		
1358	54		



1	2	3	4
1383	38	1403	78
1384	35	1404	54
1385	30	1405	74
1386	32	1406	68
1387	70	1407	62
1388	37	1408	70
1389	22	1409	60
1390	44	1410	77
1391	74	1411	54
<u>Govt.High School, Malle-</u> <u>swaram, Bangalore.</u>  <u>KANNADA MEDIUM.</u>		1412	77
		1413	35
		1414	57
		1415	77
		1416	46
1392	43	1417	43
1393	54	1418	22
1394	85	1419	50
1395	66	1420	37
1396	24	1421	80
1397	33	1422	58
1398	53	1423	41
1399	74	1424	50
1400	67	1425	81
1401	65	1426	38
1402	75		





1	2	3	4
1427	36	1450	62
	<u>ENGLISH MEDIUM</u>	1451	72
1428	64	<u>Corperation-High-School,</u>	
1429	56	<u>Bangalore.</u>	
1430	46	<u>ENGLISH-MEDIUM.</u>	
1431	65	1452	81
1432	56	<del>1452</del>	<del>41</del>
1433	56	<u>Corperation High School,</u>	
1434	43	<u>Bangalore.</u>	
1435	57	1453	41
1436	58	1454	Absent
1437	43	1455	40
1438	62	1456	51
1439	71	1457	25
1440	82	1458	54
1441	46	1459	22
1442	52	1460	24
1443	63	1461	46
1444	75	1462	16
1445	54	1463	45
1446	49	1464	43
1447	64	1465	24
1448	45	1466	24
1449	68	1467	22



1	2	3	4
1468	26	1492	38
1469	26	1493	53
1470	40	1494	63
1471	43	1495	27
1472	55	1496	22
1473	72	1497	30
1474	56	1498	43
1475	37	1499	53
1476	39	1500	27
1477	32	1501	37
1478	29	1502	23
1479	31	1503	30
1480	51	1504	61
1481	46	1505	24
1482	44	1506	20
1483	23	1507	53
1484	62	1508	34
1485	86	1509	25
1486	56	1510	45
1487	22	1511	33
1488	63	1512	74
1489	53	1513	77
1490	59	1514	75
1491	31	1515	27



1	2	3	4
1516	39	1537	55
1517	42	1538	46
<u>Govt. Central High School,</u>		1539	41
<u>Bangalore.</u>		1540	39
<u>KANNADA MEDIUM.</u>		1541	26
1518	22	1542	65
1519	78	1543	50
1520	42	1544	30
1521	30	1545	54
1522	31	1546	37
1523	44	1547	46
1524	38	1548	63
1525	26	1549	54
1526	50	1550	50
1527	45	1551	62
1528	42	1552	45
1529	53	1553	48
1530	27	1554	53
1531	73	1555	38
1532	47	1556	76
1533	56	1557	54
1534	39	1558	31
1535	27	1559	38
1536	37	1560	73



1	2	3	4
1561	32	1584	12
1562	72	1585	43
1563	72	1586	27
1564	52	1587	41
1565	31	1588	24
1566	17	1589	46
1567	40	1590	32
1568	54	1591	44
1569	44	1592	15
1570	46	1593	32
1571	53	1594	25
1572	36	1595	27
1573	50	1596	17
<u>ENGLISH MEDIUM</u>		1597	35
		1598	8
1574	30	1599	14
1575	35	1600	30
1576	12	1601	26
1577	17	1602	11
1578	21	1603	18
1579	25	1604	7
1580	22	1605	28
1581	30	1606	26
1582	17	1607	18
1583	12	1608	14





1	2	3	4
1609	24	1631	41
1610	33	1632	48
1611	10	1633	55
1612	36	1634	58
1613	39	1635	58
1614	8	1636	54
1615	63	1637	59
1616	61	1638	59
1617	16	1639	43
1618	16	1640	63
1619	77	1641	47
1620	21	1642	68
1621	8	1643	39
1622	39	1644	50
1623	20	1645	59
1624	23	1646	35
1625	52	1647	64
1626	36	1648	64
1627	19	1649	60
16		1650	40
<u>National High School,</u>		1651	49
<u>Bangalore.</u>		1652	70
<u>KANNADA MEDIUM</u>		1653	58
1628	59	1654	36
1629	45	1655	37
1630	35		



1	2	3	4
1656	49	1681	66
1657	55	1682	35
1658	38	1683	42
1659	66	1684	47
1660	44	1685	52
1661	57	1686	42
1662	55	1687	50
1663	43	1688	41
1664	62	1689	25
1665	55	<u>ENGLISH MEDIUM</u>	
1666	54		
1667	49	1690	61
1668	36	1691	80
1669	35	1692	50
1670	56	1693	55
1671	65	1694	56
1672	57	1695	67
1673	45	1696	73
1674	67	1697	66
1675	76	1698	71
1676	50	1699	45
1677	68	1700	58
1678	58	1701	70
1679	46	1702	69
1680	45	1703	52



1	2	3	4
1704	87	1729	49
1705	73	1730	62
1706	79	1731	81
1707	36	1732	65
1708	75	1733	59
1709	73	1734	69
1710	54	1735	66
1711	78	1736	46
1712	59	1737	43
1713	58	1738	70
1714	81	1739	38
1715	44	1740	68
1716	59	1741	85
1717	71	1742	47
1718	21	1743	46
1719	62	1744	60
1720	69	1745	69
1721	45	1746	64
1722	73	1747	66
1723	46	1748	78
1724	34	1749	70
1725	66	1750	64
1726	65	1751	78
1727	50	1752	80
1728	77	1753	31



1	2	3	4
1754	59	1774	21
1755	72	1775	46
1756	73	1776	45
1757	72	1777	23
1758	46	1778	40
1759	59	1779	38
1760	55	1780	70
<u>St. Joseph Convent High</u>		1781	50
<u>School, Mandya.</u>		1782	61
<u>KANNADA MEDIUM.</u>		1783	22
		1784	44
1760	55		
1761	43	1785	57
1762	44	1786	50
1763	36	1787	20
		<u>ENG. MEDIUM.</u>	
1764	62	1788	26
1765	29	1789	39
1766	40	1790	41
1767	50	1791	38
1768	57	1792	33
1769	54	1793	42
1770	20	1794	28
1771	26	1795	45
1772	29	1796	51
1773	39	1797	42





1	2	3	4
1798	61	1823	48
1799	74	1824	40
1800	44	1825	40
1801	42	1826	61
1802	46	1827	43
1803	53	1828	63
1804	51	1829	62
1805	69	Govt. High School, <u>Mandya.</u>	
1806	35	<u>ENGLISH MEDIUM</u>	
1807	32	1830	14
1808	38	1831	71
1809	33	1832	38
1810	42	1833	38
1811	39	1834	55
1812	43	1835	46
1813	39	1836	73
1814	38	1837	93
1815	60	1838	39
1816	30	1839	49
1817	24	1840	28
1818	40	1841	24
1819	39	1842	25
1820	50	1843	28
1821	29	1844	27
1822	35	1845	14
		1846	26



1	2	3	4
1847	15	<u>KANNADA MEDIUM</u>	
1848	23	1869	73
1849	34	1870	75
1850	23	1871	57
1851	12	1872	42
1852	59	1873	61
1853	48	1874	69
1854	36	1875	61
1855	57	1876	78
1856	40	1877	32
1857	38	1878	79
1858	28	1879	23
1859	81	1880	52
1860	63	1881	40
1861	46	1882	32
1862	84	1883	62
1863	90	1884	77
1864	85	1885	79
1865	28	1886	65
1866	32	1887	51
1867	37	1888	53
1868	19	1889	77
18		1890	45
		1891	64

Mysugar High School,  
Mandya.



1	2	3	4
1892	78	1916	83
1893	46	1917	71
1894	36	1918	51
1895	30	1919	61
1896	62	1920	26
1897	59	1921	61
1898	57	1922	67
1899	50	1923	55
1900	59	1924	61
1901	54	1925	70
1902	50	1926	73
1903	59	1927	65
1904	52	1928	69
1905	62	1929	72
1906	54	<u>Municipal High School,</u>	
1907	74	<u>Mandya.</u>	
1908	45	<u>KANNADA MEDIUM</u>	
1909	85	1930	53
1910	66	1931	37
1911	45	1932	43
1912	54	1933	75
1913	47	1934	65
1914	74	1935	42
1915	68	1936	29



1	2	3	4
1937	53	1961	36
1938	40	1962	17
1939	75	1963	67
1940	64	1964	46
1941	47	1965	47
1942	53	1966	68
1943	61	1967	62
1944	37	1968	36
1945	49	1969	70
1946	74	1970	52
1947	31	1971	42
1948	63	1972	48
1949	48	1973	25
1950	31	1974	60
1951	56	1975	68
1952	72	1976	34
1953	23	1977	76
1954	22	1978	31
1955	21	1979	36
1956	45	1980	31
1957	56	1981	58
1958	32	1982	19
1959	55	1983	30
1960	29	1984	50





1	2	3	4
1985	53	2009	52
1986	38	2010	73
1987	38	2011	33
1988	38	2012	32
1989	52	2013	72
1990	36	2014	48
1991	50	2015	34
1992	33	2016	27
1993	64	2017	67
1994	46	2018	17
1995	63	2019	67
1996	49	2020	26
1997	23	2021	62
1998	35	2022	47
1999	65	2023	19
2000	46	2024	48
2001	40	2025	51
2002	38	***	
2003	58		
2004	68		
2005	29		
2006	50		
2007	65		
2008	20		



[illegible]



## BIBLIOGRAPHY

- 1 Monroe, W.S. Encyclopedia of Educational Research, New York, Macmillan and Company.
- 2 Lindquist, E.F. Educational Measurements, American Council of Education, 1951.
- 3 Hawkes, H.E. Achievement Examination, George G. Harp and Co. Ltd., London.
- 4 Ross and Stanely Measurement in To-days' Schools.
- 5 Ballard Mental Measurements.
- 6 Palmer O, Johnson Statistical Methods in Research
- 7 Guilford Fundamental Statistics in Psychology and Education.
- 8 L.P. Mehrotra First Course in Educational Statics
- 9 Symmonds Percival Measurement in Secondary Education.
- 10 E.W. Menzal Suggestions for the use of New Type Tests in India.
- 11 Greene, Jorgerson and Gerburich Measurement and Evaluation in the Secondary Schools.
- 12 Buros, Oscar, K. The Fourth Mental Measurement Year Book.
- 13 Thurstone Fundamentals of Statics.
- 14 Henry Garret Statistics in Psychology and Education.
- 15 McCall Measurement, Macmillan Company. and
- 16 Beankeemath L Construction of Educational and Personal Tests, M C Graw Hill Book Co.
- 17 Thorndike, E.L. Personnel Selection.
- 18 W.L. Sumner Teaching of Science.
- 19 George Ransom Twiss Principles of science Teaching.
- 20 Bryant Conant an understanding Science



- |    |   |   |
|----|---|---|
| 21 | Arthur Thorson                              | Introduction to science.                              |
| 22 | Elword D Heirs                              | Modern science Teaching.                              |
| 23 | G.M. Ruch                                   | The objective or New Type Examination                 |
| 24 | Science Masters Association                 | The Teaching of General Science.                      |
| 25 | Fisher R.A.                                 | Statistical Tables                                    |
| 26 | Shelton                                     | Theory and Practice of General Science.               |
| 27 | Robert L. Eleel                             | Obtaining and Reporting Evidence on content validity. |
|    |   | Educational and Psychological Measurement.            |
| 28 | Poin Care                                   | Journal of Science                                    |
| 29 | Educational Research Publication            | Published by the Indian Institute of Education.       |
|    |   | <u>Reports</u>  |
| 30 | Ministry of Education Government of India   | A New Deal for Secondary Education                    |
| 31 | Proceedings of the All India Seminar        | Science Teaching.                                     |
| 32 | Radha Krishna University Commission Report. |   |
| 33 | Lakshmanswamy Mudaliar Committees Report    |   |
| 34 | Makir Hussain Committee Report.             |   |
| 35 | J.R. Reddy's Report.                        |   |